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ABSTRACT

This student section of a South Carolina industrial arts safety guide includes guidelines for developing a student safety program and three sections of shop safety practices. Safety program format, safety committees, safety inspection, and student accident investigation are discussed in the section on developing a student safety program. Set forth in the section on general safety practices are safety instructions for all areas of industrial arts; safety rules for machine tools, hand tools, and portable electric hand tools; housekeeping; back strains and proper lifting; safe lifting; materials handling; personal practices and conduct; and fire control. Section 4, on specific processes and operations, covers safety procedures relating to automotive and power mechanics; compressed gas; drafting rooms; dusts, fumes, and combustible materials; foundry practices; flammable and combustible liquids; electricity/electronics; graphic arts; soldering; and storage batteries. Examined in the section on safety procedures for machines are buffers, drill presses, forges, grinders, jointers, lathes, milling machines, presses, saws, sanders, metal shapers, shears, sheet metal machines, planer-surfacers, and welders. (A corresponding administrator and teacher guide is available separately through ERIC--see note.) (MN)

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South Carolina Industrial Arts

Safety Guide

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EDUCATION & WELFARE
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Spring – 1981

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Introduction

Accident prevention undoubtedly started back in the "caveman" days when people were first injured due to unsafe conditions and "lack of knowledge" as to how one could be hurt. For example: they found that fire would probably not spread if confined to a pit or to a wet area; if they had to handle a hot object they probably devised a glove from an animal skin so that they would not be burned.

Since that time many safeguards have been developed to protect people from their work environments.

In recent years studies have revealed that people cause more accidents than are caused by unsafe conditions. Accidents usually are the result of unsafe conditions as well as unsafe acts. People who are alert to conditions around them and know how they could be hurt will probably not have accidents.

Good safety is based upon good self-discipline and cannot be achieved without it. Sloppiness in thought or deed has no place in the prevention of accidents. Reasonable knowledge and simple self-discipline will prevent accidents.

"Safety First" is an appropriate slogan for all times. Anyone who has witnessed the result of an accident knows that there is a need for safe work habits in all activities. Not thinking before acting is the cause of most accidents. Mishandling tools or neglecting proper maintenance of tools or machinery, failing to use protective devices, and cluttered or sloppy work areas are examples of poor safety practices that frequently result in accidents.

Industry and government have endeavored to eliminate potentially hazardous conditions by the safe guarding of machinery and by providing safe work environments.

Strict attention to the task at hand is most important if accidents are to be prevented. You should become familiar with the material in this guide and develop proper safety habits.

Remember – Safety is up to you!

"What Have You Got to Lose?" S–1.0

What have you got to lose?

Your eyes

Watching television
A sunset
A good book
A friend's smile
An attractive person

Your hearing

Laughter of a friend
A bird at your window
A rock concert
The call of your name

Your hands

A game of softball
Buttoning your shirt
Driving a motorcycle
Holding hands with a special person

Your back

Playing on the beach
Getting into your car
A day skiing
Dancing
A comfortable night's sleep

Your legs

A walk on the beach
A game of tennis
Running and hiking
A bicycle ride

Your life

The remainder of today, every tomorrow. The entire rest of your life.

That's what you've got to lose!

S–1.0/

Student Safety Program

Organized safety programs are a good approach to reducing accidents.

There are many types of safety programs. The effectiveness of a good safety program is reflected in the reduction of accidents.

The program on the following pages has suggestions that can be used and/or modified to meet the needs of your school.

Safety Program Format S–2.01

Safety Committee Minutes Form S–2.02

Safety Inspection Check List S–2.03

Accident Investigation Report S–2.04

SAFETY PROGRAM FORMAT

Organization

Each Industrial Arts class should organize its own safety committee. There should be at least five student members on the committee; two members should be rotated each month. The committee should:

1. Meet every two weeks; more often if the need arises.
2. Review and approve the safety inspection report.
3. Review and discuss all safety recommendations.
4. Study the cause of accidents occurring since the last meeting.
5. Prepare minutes of the meeting and post them on the bulletin board.
6. Maintain a permanent file of accident reports, minutes, and other appropriate materials.
7. Appoint a student safety inspector.

Inspection

Inspection should be made prior to each safety committee meeting. The inspection and written report should reflect the conditions of the area – housekeeping, fire prevention, first aid equipment, personal protection equipment, unsafe work activities, hazards and guarding needed. Recommendations should be made for corrections.

Education

A bulletin board should be used to alert the class to safe work habits. A member of the committee should post safety materials and minutes of the meetings. Classroom safety meetings should be encouraged with members of the committee participating as leaders.

Accident Reports

Accident reports are an essential part of a good safety program. They help to inform, educate, and remind people of what to look for in regard to accident prevention. They also provide a record of safety items and safety activities.

1. A member of the committee should be assigned to complete accident reports in addition to the instructor's report required by the School District.

2. When a student is injured or is directly responsible for a condition that could cause an injury, that student should be encouraged to cooperate with the committee and attend committee safety meetings.

3. A member of the committee should be assigned to see that action has been taken to prevent a similar accident from taking place in the future.

SAFETY COMMITTEE MINUTES FORM

Class _____ Date of Meeting _____

Period _____ Time Opened _____

Location _____ Time Closed _____

Instructor _____

Members Present: _____

_____

_____

_____

_____

Order of Business:

1. Review of past recommendations and action taken.
2. Review of accidents since last meeting and suggested corrective measures.
3. Review of inspector's report.
4. Discussion for improvement of the safety program.
5. Selection of chairman and new members for next meeting.

_____

_____

_____

_____

_____

_____

_____

_____

(Use other side of sheet if necessary)

S–2.02

STUDENT SAFETY INSPECTION CHECK LIST

Class _____ Period _____ Date _____

Hazardous conditions and unsafe acts should be reported so corrective action can be taken. Note also whether potential accident causes, marked "X" on previous inspection, have been corrected.

( ) indicates Satisfactory

(X) indicates Unsatisfactory

A. FIRE PROTECTION
1. Extinguishing equipment . . . . ( )
2. Exits, stairs and signs . . . . . ( )
3. Storage of flammable material . ( )
4. _____ ( )

B. HOUSEKEEPING
1. Aisles, stairs & floors . . . . . ( )
2. Storage & piling of material . . ( )
3. Wash & locker rooms . . . . . ( )
4. Light and ventilation . . . . . ( )
5. Disposal of waste . . . . . ( )
6. _____ ( )

C. TOOLS
1. Power tools, wiring . . . . . ( )
2. Hand tools . . . . . ( )
3. Use & storage of tools . . . . . ( )
4. _____ ( )

D. PERSONAL PROTECTIVE EQUIPMENT
1. Safety glasses or goggles . . . . ( )
2. Face shields . . . . . ( )
3. Gloves . . . . . ( )
4. Respirators or gas masks . . . . ( )
5. Protective clothing . . . . . ( )
6. _____ ( )

E. MATERIAL HANDLING EQUIPMENT
1. Winches . . . . . ( )
2. Cranes, hoists, booms . . . . . ( )
3. Carts . . . . . ( )
4. Cables, ropes, chains, slings . . ( )
5. Rigging . . . . . ( )
6. _____ ( )

F. BULLETIN BOARDS
1. Neat and attractive . . . . . ( )
2. Display changed regularly . . . ( )
3. Well illuminated . . . . . ( )
4. _____ ( )

G. MACHINERY
1. Point of operation guards . . . ( )
2. Belts, pulleys, gears, shafts, etc. ( )
3. Maintenance & oil leakage . . . ( )
4. _____ ( )

H. PRESSURE EQUIPMENT
1. Steam equipment . . . . . ( )
2. Air compressors . . . . . ( )
3. Gas cylinders and hoses . . . . ( )
4. _____ ( )

I. UNSAFE PRACTICES
1. Improper lifting . . . . . ( )
2. Improper use of protective equipment . . . . . ( )
3. Horseplay . . . . . ( )
4. Running in aisles . . . . . ( )
5. Improper use of air hoses . . . ( )
6. Removing machine guards . . . ( )
7. Work on unguarded machinery . ( )
8. _____ ( )

J. FIRST AID
1. First aid kits . . . . . ( )
2. Stretchers . . . . . ( )
3. All injuries reported . . . . . ( )
4. _____ ( )

K. MISCELLANEOUS
1. Acids and caustics . . . . . ( )
2. New processes . . . . . ( )
3. Dusts, vapors or fumes . . . . . ( )
4. Ladders and scaffolds . . . . . ( )
5. _____ ( )

SIGNED _____

USE OTHER SIDE OF SHEET FOR DETAILED COMMENTS OR RECOMMENDATIONS

STUDENT ACCIDENT INVESTIGATION REPORT

Class _____ Period _____ Room _____

Instructor's Name _____

Name of Injured _____ Date & Time _____

Exact Location of Accident _____

Description of Accident* _____

Indicate below with an "X" whether in your opinion accident was caused by one of the following:

PHYSICAL CAUSES

( ) Improper protection (personal or equipment)
( ) Defective tools or equipment
( ) Hazardous arrangement
( ) Improper illumination
( ) Poor housekeeping
( ) Not listed - describe briefly*

_____
_____

PERSONAL CAUSES

( ) Physical or mental defect
Lack of knowledge or skill
( ) Wrong attitude
( ) Use of intoxicants or drugs
( ) Not listed - describe briefly*

_____
_____
_____
_____

UNSAFE ACTS

( ) Working without authority
( ) Failure to secure or warn
( ) Working at unsafe speed
( ) Used unsafe equipment or hands instead of equipment
( ) Not listed - describe briefly*

( ) Unsafe material handling
( ) Took unsafe position
( ) Worked on moving equipment
( ) Horseplay
( ) Did not use safe clothes or personal protective equipment

_____
_____

NOTE: Make certain of names and descriptions of witnesses, injured sent to hospital, condition of injured, assistance by others, etc.

Actions taken to prevent a similar future accident* _____
_____
_____
_____

Date of Report _____ Signature _____

* USE OTHER SIDE OF SHEET IF NECESSARY.

S–2.04

General Safe Practices

Safety rules have been developed to alert you to unsafe practices and conditions. These rules, in some cases, are common to all work. In other instances, they are specific to the particular task at hand.

It is important that you learn these rules and apply them to your Industrial Arts and other activities.

Safety Instructions for All Areas of Industrial Arts S–3.01

Safety Rules for Power Tools S–3.02

Safety Rules for Hand Tools S–3.03

Safety Rules for Portable Electric Hand Tools S–3.04

Housekeeping S–3.05

Back Strains and Proper Lifting S–3.06

Safe Lifting Cartoon S–3.07

Materials Handling S–3.08

Personal Practices and Conduct S–3.09

Fire Control S–3.10

SAFETY INSTRUCTIONS FOR ALL AREAS OF INDUSTRIAL ARTS

1. Instructor approval must be obtained for work on all machines or in potentially hazardous areas.
2. Report all injuries, however slight, to your instructor immediately.
3. Wear eye protection as required by law.
4. If your hairstyle presents a potential hazard, you must fasten it securely or wear a protective hair cover.
5. Suitable clothing must be worn for all laboratory activities. Remove or fasten any loose clothing, neckties or jewelry. Roll loose sleeves to elbows.
6. Obey rules concerning operators' safety zones.
7. Cooperate with your classmates in the management of your Industrial Arts safety program.
8. Caution any student committing an unsafe act.
9. Report to instructor any equipment that does not seem to work properly.
10. Keep tools and materials from projecting over the edge of benches.
11. Use a brush to clear away dry chips. Use a rag to clean oily areas.
12. Keep floor and work surfaces clear of scraps and litter.
13. Wipe up immediately any liquids spilled on the floor.
14. Be sure projecting drawers and doors are kept closed.
15. Place oily rags and other combustible materials in approved metal containers.
16. Use care in handling and storing large, heavy or long pieces of material.

SAFETY RULES FOR POWER TOOLS

1. Do not operate any machine until you have received proper instruction, fully understand how to operate it, and have received the instructor's permission to use it.
2. Wear proper eye protection devices when in potential eye hazard areas.
3. Have your instructor check your work setup.
4. Check and make all adjustments before applying power.
5. Make sure other persons are clear before turning on the power.
6. Guards must be in place and function properly.
7. Start and stop your own machine and remain with it until it has come to a complete stop.
8. Only one person should operate a machine unless the operation requires a helper.
9. Do not leave a running machine unattended.
10. Disconnect electrical power before oiling and cleaning.
11. Allow a safe distance between your hands and blades, cutters or moving parts. Keep fingers in such a position that there is no danger of their slipping into the cutter or moving parts.
12. Keep machines clear of tools, stock, and other items.
13. Keep the floor around machines clear of liquids, scraps, tools, and material.
14. Give the machine your undivided attention while you are using it. Do not look away to talk to others.
15. Never lean or lounge on any machine.
16. Do not use extension cords for permanent connections.
17. Notify your instructor of any breakage or malfunction.
18. Allow all machines to come to a complete stop before removing work or making a new setup.

SAFETY RULES FOR HAND TOOLS

1. Wear adequate eye protection devices when in potential eye hazard areas.
2. Select the proper size and type of tool for the job. Learn and follow the correct procedure for using each tool.
3. Cutting tools must be properly sharpened and in good condition.
4. Keep your hands free of oil and grease.
5. Handle sharp-edged and pointed tools with care; carry in such a way as to protect yourself and others.
6. Secure small or short work with a vise or clamp.
7. Never carry tools in your pockets.
8. Use tools only for the purpose for which they were intended.
9. Do not use tools with loose or cracked handles.
10. Keep punches and chisels in good condition. Mushroomed heads may chip and cause injuries.
11. Use a file only when it is equipped with a handle.
12. Never pry, hammer on, or hammer with a file; it may shatter.
13. Do not use screw drivers as chisels or pry bars.
14. The use of a "cheater" on any other means for increased leverage is hazardous. All wrenches are designed to a specific size-length-strength ratio.
15. Do not use a hard hammer on another hardened surface.
16. When finished with a tool, clean it and return it to the proper storage place.
17. Report any breakage or malfunctions to your instructor.

SAFETY RULES FOR PORTABLE ELECTRIC HAND TOOLS

1. Instructor permission must be obtained before using portable electric tools.
2. Be sure that the switch is in the "off" position before you "plug in" the electric cord.
3. Eye protection must be worn when operating all portable electric tools.
4. The switch on each equipment handle should be the constant pressure (dead-man) type. That is, when pressure is released, power is shut off.
5. Be sure that equipment is properly grounded – do not use in wet areas.
6. Do not wear loose or baggy clothing that could be caught in revolving parts.
7. Before starting, be sure that you have a good footing and that your work area is free of obstacles.
8. The electric cord should be inspected for breaks or exposed wires before using.
9. Excessive pressure while operating portable electric tools may damage the tool and cause an accident.
10. All work should be properly secured before applying the tool.
11. Guards should be inspected before starting, to see that they function properly.

HOUSEKEEPING

Good housekeeping is a key item in accident prevention. It takes the cooperation of all; it can't be the responsibility of the instructor and custodian alone.

An effective housekeeping program will:

1. Reduce exposures to slips and falls;
2. Reduce fire hazards;
3. Remind individuals of their responsibilities in keeping the laboratory clean and orderly;
4. Organize the housekeeping effort so that everyone assumes their fair share of the task.

Good housekeeping cannot be accomplished by an occasional grand cleanup. A program must be developed for continual cleanup. The following are essential in a good housekeeping program:

1. The equipment is arranged to permit safe and efficient work practices;
2. Materials and supplies are neatly and safely stacked;
3. Sufficient waste containers are provided and used;
4. Floors are clean;
5. Combustible materials are properly disposed of or stored in approved containers;
6. Excess materials and debris are not allowed to remain on benches and in the work areas;
7. Regular inspections are made to maintain clean and orderly conditions.

Items that are necessary for good housekeeping in an Industrial Arts laboratory are:

1. Adequate dust collecting system;
2. Suitable containers for scraps, shavings, chips and other waste material;
3. Adequate storage rooms, shelves, racks, and cabinets for materials and supplies;
4. Splash guards and collecting pans for all machines using oil and coolants;
5. Brooms, bench brushes, shop towels, and other cleaning equipment.

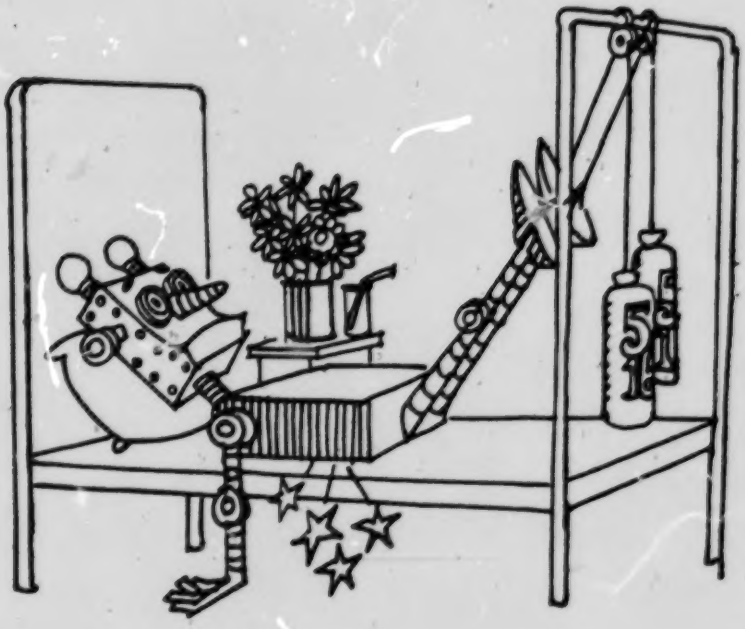
<u>IT IS YOUR RESPONSIBILITY TO SEE THAT HOUSEKEEPING TOOLS, EQUIPMENT AND SUPPLIES ARE PROPERLY USED.</u>

BACK STRAINS AND PROPER LIFTING

Back strains due to improper lifting probably cause more lost time from work than any one single type of injury.

Accidents in manual handling of materials are mainly the result of unsafe working habits – improper lifting, carrying too heavy a load, incorrect gripping, and failing to wear personal protective equipment.

Training in proper methods of lifting is mandatory in any safety program. Good lifting practices can prevent many back strains.

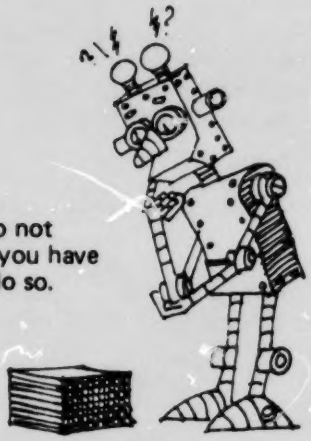


Improper lifting could injure you for life. Study the next page to learn proper lifting methods.

Safe Lifting

1

First, size up the load - do not attempt to lift it alone if you have doubt in your ability to do so.



2

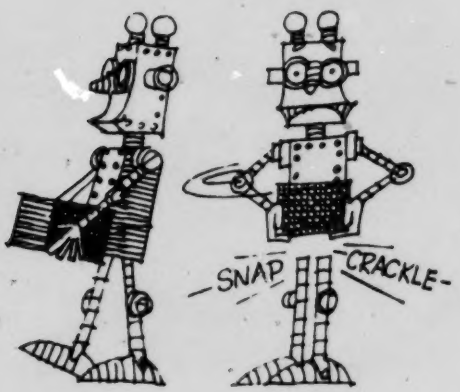
Make sure that your footing is secure. One foot may be forward of the other to attain good balance.

3

Bend the knees and squat (don't stoop) keeping the back as nearly vertical as possible. Spread knees or lower one knee to get closer to the object

4

Now start pushing up with your legs. Keep the load close to your body as you come up.



5

Lift the object to the carrying position. Do not twist the body. Turn your body by changing the position of the feet.

6

In lowering the load to the floor, bend the knees. Keep the back straight with the load close to the body, lowering the load with the arm and leg muscles.

S–3.07

MATERIALS HANDLING

According to the National Safety Council, nearly one in four disabling injuries is directly related to materials handling activities. These accidents include such things as slips and falls while carrying objects, back injuries and hernias from improper lifting practices, chemical and heat burns from failure to use protective clothing or equipment, and mashed or amputated fingers or toes from dropped objects.

Some of the things you can do to reduce the chance of injury to yourself or others when handling materials are:

1. Use the proper aids to handle the materials, such as tongs for hot materials, block and tackle or jacks to lift extra heavy items, and blocks or wedges to keep items from rolling.

2. Don't try to lift heavy objects without help; before you lift make clear who is giving the orders.

3. Use proper lifting techniques (see Page S–3.07).

4. If the material is heavy or sharp use gloves or pads to assure a better grip or to avoid cuts. Be careful of splinters when handling lumber; wear gloves to handle rough lumber.

5. Before you pick up an object be sure that the path you intend to follow is clear.

6. With heavy objects, make a "first lift" before carrying it so that you can get the feel and position.

7. With long objects, such as pipe or ladders, have someone at each end so that they can be safely guided.

8. Be careful not to drop or set heavy objects on your feet or those of other people.

9. Stack materials so that there is no danger of slipping or falling during storage or removal.

PERSONAL PRACTICES AND CONDUCT

Accident prevention is up to you. There are certain basic rules of conduct that you should incorporate in your daily activities. These rules all involve your attitude toward your fellow worker as well as your attitude toward the task at hand. People with a poor job attitude are those that most frequently have accidents.

Orderliness is a desirable quality. Safe workers will have a methodical approach to the job. They will lay out tools neatly so that they are able to approach the project in an orderly manner. They will not clutter up their work area with excessive tools and materials.

A safe worker is a clean worker. Messy jobs require continual cleanup of the work area and frequently of the worker.

Horseplay in the laboratory will not be tolerated. Severe accidents often have occurred because individuals:

1. Threw items in the laboratory;
2. Ran in the laboratory;
3. Lacked consideration for others;
4. Directed compressed air toward others;
5. Played tricks on others – hot metal, electrical shock, glue in pockets, etc.;
6. Did not adhere to the accepted safe practices of a laboratory environment.

FIRE CONTROL

The fighting of fires is normally left to professional fire fighters such as the local fire department, but the student should know how to extinguish fires.

Serious fires may occur in the Industrial Arts laboratory in spite of the efforts of everyone. Should this happen, the procedure will be:

1. Sound the alram, both locally and to the fire department.
2. If a person's clothing is on fire, extinguish it. Water is most effective. Do not let a person with burning clothing run. (Melted, synthetic clothing can give serious burns if extinguished by rolling on the floor or using a blanket.)
3. Evacuate to a safe spot clear of the fire area and remain in a group so it will be easy to check for missing persons.
4. When the fire has been extinguished, clean up and protect wet or damaged equipment and materials. Be alert for rekindling of the fire.

Fires and Extinguishers

There are four principal classes of fires. No one extinguishing agent works well on all although some work on most.

Class A: This is the most frequently found fire involving wood, paper, rubber and most plastics. Use water, chemical extinguishing solutions containing water, or Class A dry chemical (they crust and smother the glowing embers).

Class B: Flammable liquids are commonly used in the Industrial Arts laboratory and can be difficult to extinguish. Dry chemicals are most effective, followed by foam, inert gas, and water spray. A flammable liquid fire in a container can be extinguished by putting a lid on the container. Remember that the heat from a flammable liquid fire can quickly ignite wood or paper in the vicinity, making extinguishment more difficult.

Class C: This covers electrical fires. Remember that the first step in extinguishing an electrical fire is shutting off the power to the equipment that is on fire. Then extinguishers with a Class C rating may be used to complete extinguisment. It may be necessary to use water if the electrical fire has involved other combustible materials. AVOID USING WATER ON ELECTRICAL EQUIPMENT THAT IS NOT DE-ENERGIZED UNLESS IT IS APPLIED IN A FINE SPRAY, AND EVEN THEN CAUTION MUST BE TAKEN TO AVOID ELECTRICAL SHOCK FROM TOUCHING "LIVE" SURFACES.

Class D: Certain metals such as magnesium and powdered aluminum may burn intensely. In general the extinguishing method involved excluding air and moisture with dry sand or special metal fire extinguishing powder.

Safety Practices. . .Specific Processes and Operations

In spite of one's knowledge of general safety, alertness to potential hazards, or desire to "be safe" there are certain processes and operations that require specific knowledge in order to avoid injury.

Safety rules for specific areas are as follows:

Automotive and Power Mechanics S–4.01

Compressed Gas S–4.04

Drafting Room Safety Practices S–4.05

Dusts, Fumes & Combustible Metals S–4.06

Electricity/Electronics S–4.07

Flammable & Combustible Liquids S–4.08

Foundry Safe Practices S–4.10

Graphic Arts S–4.11

Plastics S–4.15

Soldering S–4.16

Storage Batteries S–4.17

Note to Teacher and Students: This guide is not intended to provide all of the instructional and safe practices information that students will need to know to successfully and safely participate in their Industrial Arts activities. Each instructor and student is expected to seek out and use additional instructional material. Highly technical information not available in the average text should be obtained by contacting specialists in the field.

Additional information on safety and hygiene may be obtained from:

Department of Labor and Industries
3600 Forest Drive
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AUTOMOTIVE AND POWER MECHANICS

Safety is one aspect of the automotive repair industry that cannot be overemphasized. A good mechanic is a safe mechanic. If there is a fast way or a safe way to do the job, take the safe way. Otherwise, you may not get the job done at all.

Listed below are some of the potential exposures and safety precautions that you will be confronted with.

General Precautions:

1. Oil or adjust moving parts only if authorized.
2. Use caution when working near the fan and belt.
3. Whenever possible, work with the engine switch in the "OFF" position.
4. The fan belt should be tightened only when the engine is stopped.
5. Always consider the engine and exhaust system to be "HOT".
6. Do not pour gasoline from an open container into the carburetor.
7. Use extreme care when welding on vehicles – provide fire protection.
8. Do not work directly above another student.
9. Wait for the radiator to cool before removing the cap.
10. Make sure that hoods are secured in an open position when working on the engine.
11. When "pulling engines" be sure that ropes or slings are properly fastened.

Personal Health Hazards:

1. Wear respirators while spray painting.
2. Do not clean hands in solvent or gasoline. These materials are explosive and also can cause a skin rash.
3. Avoid back strain when it is necessary to lift parts from the engine.
4. Never place hands in front of a high pressure grease gun.
5. Keep open wounds properly dressed and covered.
6. Do not wear loose clothing or long hair.

Jacking and Hoisting:

1. Do not jack up the vehicle if a student is under it.
2. Jack stands must be used when working under vehicles.
3. Avoid excessive shaking of the vehicle when on jack stands.
4. Have the instructor inspect the jack stand supports before students work under any vehicle.
5. Long jack handles are a serious tripping hazard and they should be barricaded or raised out of position.
6. Do not use bumper jacks.
7. Do not run an engine when the car is on the hoist.
8. Caution should be observed when lowering a vehicle.

Driving and Locating the Vehicle for Work:

1. Do not wear eye protection with restricted vision when driving a vehicle in the shop.
2. Vehicles should be driven only by students with valid driver's licenses and with the instructor's permission.
3. Work should not be performed on vehicles parked in heavily travelled areas or on public thoroughfares.
4. Towing or pushing should be done only with instructor approval.
5. Have a fellow student guide you when parking a vehicle in a congested area.
6. Someone must be in the driver's seat of a vehicle when the engine is being started.

Greases, Oils, Fuels and Solvents:

1. Clean up all spills immediately and ventilate.
2. Use only approved solvents for cleaning parts. Do not use gasoline.
3. Be sure that there is proper ventilation before an engine is started.
4. Keep oil-soaked rags in approved rage waste containers.
5. Check fuel connections for leaks before starting an engine.
6. Keep flammable liquids in closed approved containers.

Air Pressure:

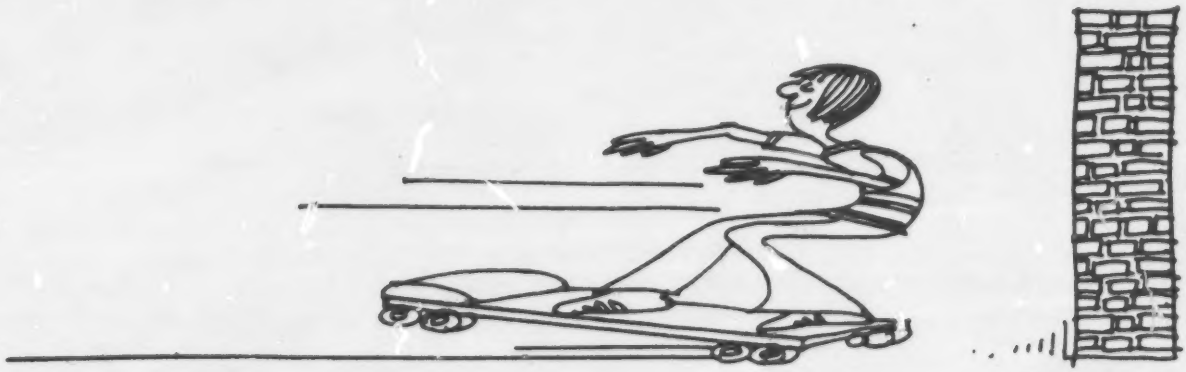
1. Use an air gauge when inflating tires.
2. When inflating truck tires that have a snap ring, the tire should be confined within an approved cage.
3. Never aim an air hose at another student or at yourself.

Wrenches and Tools:

1. Keep all tools clean and free of oil and grease.
2. Keep tools picked up from the floor.
3. Make certain that wrenches fit properly.
4. Hammers with loose handles should not be used.
5. Use tools only for the purpose for which they are designed – never use a file as a pry bar.
6. Creepers should be stood on end or stored in a rack when not in use.
7. Do not use chisels or punches with "mushroom" heads.

Carbon Monoxide:

Carbon monoxide is a poisonous gas caused by incomplete burning of gasoline or other fuels. It is present in gaseous form when the engine is running. Even a small amount of carbon monoxide in our body can be fatal; that is why it is imperative that you never run an engine in a poorly ventilated area.



COMPRESSED GAS

The most commonly used gases for cutting and welding are oxygen and acetylene. However, you may also be using hydrogen, nitrogen, Maap gas, argon, helium, "Freon", ammonia, propane (liquefied petroleum gas), carbon dioxide or sulphur dioxide in some of your projects.

To use them safely you need to know their characteristics and be sure you are using the right bottle. There is no standard color code for compressed gas bottles! Read the labels.

Treat compressed gas cylinders with the greatest respect. There is an immense amount of power in each cylinder. Careless handling resulting in valve or cylinder damage can produce instant death for you or your friends. Use a cart or hand truck for moving cylinders.

Flammable Gases:

Acetylene, hydrogen, propane and Maap gas are highly flammable. They are normally handled in compressed gas cylinders or tanks. Acetylene is dissolved in acetone (Maap gas and propane are liquefied by pressure), so it is especially important that these cylinders be kept upright when in use.

They will all form violently explosive mixtures with air or oxygen, so valves, regulators, hoses and other equipment must be tight and in good repair. Shut off valves and regulators when they are not in use!

Store spare flammable gas cylinders in a well ventilated location, separated by a fire resistant barrier – preferably outside.

All gas cylinders must be secured and stored erect at all times. When storing or moving, cylinder caps must be in place. Students should not move cylinders unless secured to carts.

Oxygen:

For shop use, this gas is in a class by itself. It will combine with many common materials, and under the right conditions will cause these materials to burn violently or to explode. Oxygen under high pressure can cause oils to explode. NEVER USE OIL ON ANY OXYGEN VALVE OR REGULATOR EQUIPMENT!

If you change cylinders, always have the instructor check your work before opening the valve.

Non-Flammable Gases:

These include nitrogen, argon, helium, "Freon", sulphur dioxide, and to some extent ammonia, which is flammable only in high concentrations. Some are odorless, and others (sulphur dioxide, ammonia) have extremely strong odors. None will support life, so adequate ventilation of the use area is essential. Read up on the specific characteristics and detailed safety precautions for the gas you will use and discuss them with your instructor before proceeding.

DRAFTING ROOM SAFETY PRACTICES

Although few hazards exist in the drafting room, there are some safety factors that must be considered.

1. The paper cutter used in most drafting rooms could be responsible for serious cuts and pinches. In most cases, it is advisable to have it fastened in a permanent location and when not being used it should be locked in the closed position. A barrier type guard secured to the paper cutter should be no higher than 3/8" from the table, and located between the operator's hands and the blade. Do not remove guard.

2. Ozalid printers and developers, because they use ammonia, call for special safety instruction. Ammonia fumes in concentrated form are very toxic and should only be used in a well-ventilated area. Students should be advised not to inhale the fumes. If ammonia is spilled on the skin, it should be washed off immediately with soap and water.

3. Improper handling and use of compass, dividers, and hard lead pencils may result in painful skin punctures and eye injuries which can lead to infection or blood poisoning.

4. When sitting on a chair or stool be sure to keep all four legs on the floor. A major problem in the drafting room is injury resulting from falls from tilted chairs or stools.

5. Use care in adjusting the adjustable table tops.

DUSTS, FUMES AND COMBUSTIBLE METALS

Dust or fumes (fine metal particles from burning) found in the Industrial Arts laboratory can be irritating to some people. Some can be highly flammable or explosive and possibly cause serious or permanent illness.

It is important to control classroom exposure by:

1. Using the ventilation equipment to remove dusts from your work area;
2. Sweeping or vacuuming and properly disposing of dusts produced;
3. Wearing a dust respirator when working on dust producing operations;
4. Consulting your instructor before cutting, welding or grinding on galvanized metals.

Asbestos dust is a particular hazard that requires extra precaution when cutting or drilling or machining. Respirators and protective clothing must be worn when working with this material.

Certain metals such as magnesium are flammable and unstable and should not be used in the Industrial Arts Laboratory.

When working with lead or zinc, whether burning, welding, soldering, melting, or machining, good ventilation is essential.

ELECTRICITY/ELECTRONICS

1. Adequate eye protection is needed when soldering.
2. When soldering or de-soldering, never "flick" molten solder.
3. Consider all wires and terminals as live and "HOT" until proven otherwise by a safe method of testing.
4. Resist the temptation to throw a switch just to see what happens.
5. Turn off power before replacing fuses.
6. Locate and correct the cause of a blown fuse or tripped circuit breaker before replacing fuse or resetting breaker.
7. Experimental circuits and wiring practice boards should be fused properly.
8. Make wiring changes only with power OFF.
9. Disconnect or unplug appliances and equipment before attempting repairs.
10. Make it a habit to inspect cords and plugs for defects.
11. Make sure portable electrical devices are properly gounded.
12. Never attempt to use a piece of electrical equipment known to be faulty.
13. High voltage chassis should be kept clear of any grounded conductors. Use an isolation transformer.
14. Make sure capacitors are discharged before touching.
15. Make it a habit to keep one hand in your pocket or behind your back when using a test probe.
16. Wear gloves and a face shield when handling cathode-ray tubes. WARNING: CATHODE-RAY TUBES ARE AN EXTREME EXPLOSION HAZARD. An instructor should be present when handling cathode-ray tubes. CRT's are under a low vacuum and if broken an explosion will result, causing glass to be thrown over a considerable area. WARNING: CRT's store a high electrical potential (approximately 20,000 volts). Severe shock hazards exist if the tube is not properly grounded before work commences.
17. Metal jewelry, watches, rings, chains, etc., should not be worn when working on electrical equipment.
18. Follow instructions when handling and charging storage batteries.

FLAMMABLE AND COMBUSTIBLE LIQUIDS

Flammable and combustible liquids are essential in many Industrial Arts classes. They must be stored and used in a manner that will provide a high degree of safety.

Always read the label on the container before using any of these materials.

Flammable and Combustible Liquids are Potentially Dangerous Because:

1. Many produce vapors that are heavier than air and can accumulate along floors or other low points, lying in wait for a stray spark.
2. Many are readily oxidized, or release heat in curing so that rags or waste coated with them will catch fire spontaneously.
3. Vapors from some have harmful effects and can cause damage to nervous and/or waste elimination systems of the body.
4. All are poisonous if taken internally.
5. Most will remove protective oils from the skin, and repeated exposure can cause dermatitis (skin rash).
6. Nearly all will burn violently. Such fires are difficult to extinguish without proper extinguishing agents.
7. When burning, most flammable liquids will produce dense black smoke that may drive you from the room before the fire can be put out.

Store and Handle Flammable and Combustible Liquids Safely:

1. Be sure the exhaust fan or vents are operating in the flammable liquids store room.
2. Draw out only as much as you need for your class period or particular operation.
3. Dump waste or excess materials only in covered metal containers, as directed by the instructor.
4. Use a funnel when pouring into a small container.
5. Clean up spills and drips immediately, disposing of the rags and waste material as instructed.
6. Read and follow instructions for handling and mixing catalysts with resins or finishes.
7. Never pour catalysts back into the bottle.
8. Always add catalyst to resin, not resin to catalyst.
9. Never apply resin, paint or other finishing material near areas used for cutting, welding, grinding or other hot work.

10. Be sure that the working area is well ventilated.

11. Store thinners and solvents only in original purchase containers or approved cans.

12. Use rubber gloves to minimize chances of skin irritation when working with epoxy and polyester resins.

13. Wash hands and other exposed skin areas before leaving the shop.

Some of the most hazardous flammable liquids that you may encounter in your shop activities are (listed in approximate order of hazard):

Starting fluid

** Aerosol cans

Gasoline

* Catalysts M.E.K. Peroxide

Carburetor cleaner

Acetone

Lacquer and lacquer thinner

Adhering liquid (for silk-screen process)

Paint thinner

Alcohol

Shellac

* Japan dryer

Kerosene

Paint

Resin (polyester)

Stain and varnish

Danish oil

* These materials could accelerate spontaneous combustion or could react violently when mixed with organic material.

** The hazard could vary greatly depending upon the propellant used in the can.

FOUNDRY SAFE PRACTICES

Safe practices in foundries must be observed at all times. Mishandling of molten metals can cause serious third degree burns, resulting in permanent disability.

1. Wear proper protective clothing when handling molten metal; safety glasses and face shield or helmet, apron, leggings and asbestos gloves; tennis shoes or sandals are not acceptable.

2. Always treat crucibles, flasks, castings and other equipment as if they are hot; determine if they are hot before picking them up.

3. Ask your instructor to check your mold before closing it. Be sure it is not too damp before pouring – it could explode.

4. Keep flammable materials away from the foundry area – paints, solvents, etc.

5. Light the furnace only when supervised by your instructor. Follow the manufacturer's directions. The following are generally accepted procedures:

   a. Turn on area vent fan;

   b. Purge furnace by running air for 2 minutes with the gas off;

   c. Reduce air flow;

   d. Place a lighted torch in the furnace (if no auto-pilot);

   e. Add gas slowly; if flame is blown out, start over with (a);

   f. Slowly increase air flow.

   g. Adjust flame so that it is contained within the furnace.

6. Before removing crucible, shut off the gas first, then the air. Use a crucible lifter to remove crucible from furnace.

7. Carry molten metal as close to the floor as possible using a two-man pouring tool.

8. Keep water and wet items away from the foundry area, except for tempering sand.

9. The foundry pouring area floor should be protected with sand to prevent accidental "floor explosions" caused by spills of molten metal.

10. In consumable pattern casting (styrofoam), keep the sprue basin filled to prevent firing; turn on foundry room area vent fan; do not breathe fumes.

11. In hot shell or CO_2 shell molding, the two halves of the mold should be securely fastened and banked in a flask of green sand to dissipate heat; do not breathe fumes.

GRAPHIC ARTS

Many of the equipment items and materials used in the graphic arts program are heavy, sharp, brittle, or awkward to handle. Size up the task before you attempt it and get help if needed. Recognize the inherent delicate nature of much of the equipment and do not abuse it.

Some safety precautions for the graphic arts area follow.

Dark Room:

1. Turn on ventilator fan when in the dark room.
2. Chemicals should not be stored in glass bottles or on high shelves where they may fall and cause injury.
3. Chemical goggles and apron should be worn when preparing chemical solutions. Always add acid to water – never the opposite.
4. Tongs or rubber gloves should be used in handling film in the developing process.
5. Students who have allergies must wear rubber gloves while handling film or mixing chemicals.
6. Students are to keep hands away from face while working in dark room.
7. Students should wash hands carefully after developing film.
8. Portable electrical devices should not be used around or within reaching distance of sinks.
9. There shall be no unsafe conduct in the dark room.
10. All spills should be wiped up immediately.
11. Avoid chemical spills on clothing. Such spills may cause skin irritation.

Dry Mount:

1. Students should be cautious to avoid burning themselves on press or tacking iron.
2. Dry mount with heat setting prescribed by the instructor only.
3. Turn off and unplug press and tacking iron at end of the process.
4. Do not lay hot tacking iron down on papers or on the counter but return it to holder.
5. Report worn electrical cords and plugs to instructor.
6. Never test heat of press or tacking iron by touching.

Process Camera:

1. Do not touch hot lights.
2. Avoid flashing lights in students' eyes.
3. Caution should be exercised around glass copy board.

Offset Press:

1. The press must be stopped before adjusting, cleaning (except when cleaner attachment is being used), oiling, and clearing of jams.
2. Do not reach over the press during operation.
3. When a malfunction is observed on the press it should be shut down and the instructor informed before continuing. Do not attempt any repairs.
4. The press shall be operated only at the speed designated by the instructor.
5. Utilize caution when cleaning a moving press.
6. Students are not to use any tools on the press without the instructor's permission.
7. Be sure clothing is safe for press work. Remove or fasten any loose clothing, neckties, or jewelry. Roll loose sleeves to elbows.
8. If your hairstyle presents a potential hazard, you must fasten it securely or wear a protective hair cover.
9. Keep floor clear and clean at all times.

Stripping Tables:

1. All foreign material should be kept off the glass so it will not be broken.
2. Keep fingers out of cutting area when cutting a flat.
3. The cutting devices should be stored properly and kept sharp.

Folding Machine:

1. Never attempt to remove a misfed or jammed sheet while the machine is running.
2. Turn off the power when making changes.
3. Keep all tools off the tables of the folder.
4. Be sure electrical cord is out of the way.

Paper Cutter:

1. The cutter knife is to be changed by the instructor only.
2. Items other than the paper to be cut are to be kept off the cutter table at all times.
3. Keep the floor clean around the cutter; throw trimmings in the trash barrel.
4. Keep both hands on the lever throughout the complete cutting cycle. Be sure knife is in full up position before taking hands off levers.
5. Never raise clamp higher than knife blade.

Plate Maker:

1. Disconnect the plate maker before changing carbons or making adjustments. Be careful of hot carbons when changing.
2. Never look at arc lights during operation.
3. Be careful not to break glass of vacuum frame.

Paper Drill:

1. Be aware that drill bit may be hot.
2. Keep hands away from drill area while drilling.
3. Keep area around feet clear at all times.

Air Brush:

1. Have instructor connect and disconnect regulators to high pressure air line.
2. Do not adjust regulators.
3. Take care not to spray toward other students' faces.

Sign Press:

1. Do not throw or toss type.
2. Utilize caution in keeping hands out of roller.
3. Use only specified cleaning solutions in cleaning type and press.
4. Do not lift or carry press during cleanup.

Platen Press:

1. Keep hands out of platen when lever is pulled down.
2. Do not retrieve or adjust paper during the printing cycle.
3. Clean ink platen and rollers as instructed.

Engraving:

1. Goggles must be worn when engraving.
2. Keep hands from under cutter bit.
3. The instructor will change or adjust engraving cutters.

Thermography:

1. Dark goggles must be worn by all students in the area when heating the relief powder.
2. Students in the area are not to stare at the heat lamp.
3. Do not leave area when the lamp is on and relief powder is heating; fire may result.

Rubber Stamp and Gold Stamping:

1. Exercise caution when using heating element.
2. Keep work surface clean at all times.
3. Do not throw or drop type.

PLASTICS

1. Wear proper eye protection.
2. Never inter-mix anything unless you understand the reactions of the mixture.
3. Use proper ventilation, as toxic vapors may be given off.
4. Many liquids and resins will build up concentrations of vapors which have a low flash point; no open flames are allowed when working with these types of materials.
5. Use proper protection against materials which might cause skin irritation – wear plastic gloves, face shield, etc.
6. Wear protective gloves for handling hot plastic.
7. Use a face mask and respirator when sanding fiberglass or other materials that make hazardous dust.
8. Keep materials with low flash points under refrigeration.
9. Keep all guards in place when operating any plastics machines.
10. Warning signs and protection should be provided at each heating unit.
11. Use only recommended materials and procedures for injection mold forming processes.
12. When using wood and/or metal working equipment, follow the safety rules for those machines.
13. Clean up area and return all equipment and tools to proper storage. Properly dispose of all flammable waste material.
14. Certain catalytic reactions produce a great deal of heat – such should be mixed in metal containers only.
15. Always add catalyst to resin – not resin to catalyst.

SOLDERING

Soldering is a process used for fastening two metals together by use of a molten metal. The exposures are mainly burning yourself or someone else.

You should keep in mind the following safety rules:

1. Wear adequate eye protection.
2. Before attempting to light a bench soldering furnace, make sure that the gas is turned off.
3. If the furnace does not have a pilot light:
   a. Place a match or lighted piece of paper in the furnace;
   b. Slowly turn on the gas until it ignites;
   c. Adjust the flame so that all fire is contained within the furnace.
4. Work in a well-ventilated area.
5. Do not inhale fumes from soldering processes.
6. Use care in removing excess molten solder from the copper; wipe off with steel wool – do not flip it off.
7. Clean up spilled flux immediately.
8. Wash hands after soldering. Flux can cause burns to the skin or damage clothing.
9. In case of acid burns, flush immediately with water.
10. Be aware of the rapid rate of heat transfer throughout thin metal.
11. Do not use electric guns or irons while standing or working in wet areas.
12. Care should be taken not to cut or burn the electrical cords on electric soldering guns or irons.
13. Clean up area.
14. Do not leave hot metals where others can contact them.

STORAGE BATTERIES

The storage battery that you are most likely to come in contact with is the automotive storage battery. Because of its compact size and the fact that it is so common, sometimes we tend to become careless in our use of the battery.

The following are some rules of caution:

1. Batteries should be stored or charged only in well ventilated areas. Do not breath fumes of battery acid.
2. All sources of ignition should be remote from the battery storage area; i.e., no smoking, no lighted matches, no sparking from tools.
3. Do not work on batteries while on discharge or charge.
4. Proper protective clothing should be worn when handling batteries; i.e., rubber gloves, face shield, apron.
5. Metal jewelry such as rings, bracelets or necklaces should not be worn around batteries.
6. Deluge showers and eye baths should be provided adjacent to the battery charging area.
7. Acid spills can be neutralized with a weak ammonia solution or a bicarbonate of soda solution, or diluted by large quantities of water applied immediately.
8. Battery chargers should be connected or disconnected only when charger is off and caps are in place.

Some of the more serious potential hazards from batteries are:

1. Explosion due to improper connections.
2. Acid spills by incorrectly handling.
3. Back strain from improper lifting.

Safety Practices . . .Machines

Safety rules for the following machines are included in this section.

Buffer S–5.01
Drill Press S–5.03
Forge, Gas S–5.05
Grinder S–5.07
Jointer S–5.09
Lathe, Metal S–5.11
Lathe, Wood S–5.13
Milling Machine S–5.15
Planer-Surfacer S–5.17
Press, Offset Printing S–5.19
Sander, Portable Belt S–5.21
Saw, Band S–5.23
Saw, Portable Circular S–5.25
Saw, Radial Arm S–5.27
Saw, Scroll S–5.29
Saw, Table S–5.31
Shaper, Metal S–5.33
Shear, Metal Squaring S–5.35
Sheet Metal Machines S–5.37
Welder, Arc S–5.39
Welder, Oxy-Acetylene S–5.41

OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Buffer

SAFETY SUGGESTIONS

1. Always buff using the lower half of the wheel (below center).
2. Always wear eye protection when buffing.
3. Always stand to one side of the wheel when buffing and when applying compound.
4. Never use a rag to hold the work while you are buffing.
5. Use extra caution when buffing around corners, openings or areas where the wheel could grab and throw the work. Do not buff small diameter tubing, wires, chain or similar material.
6. Exercise caution so that the work does not overheat and burn your hands.
7. Be sure the area behind the buffer is open and that no one else is in the safety zone.
8. If your hairstyle presents a potential hazard, you must fasten it securely or wear a protective hair cover.
9. Remove or fasten any loose clothing, neckties or jewelry. Roll loose sleeves to the elbow.

BUFFER

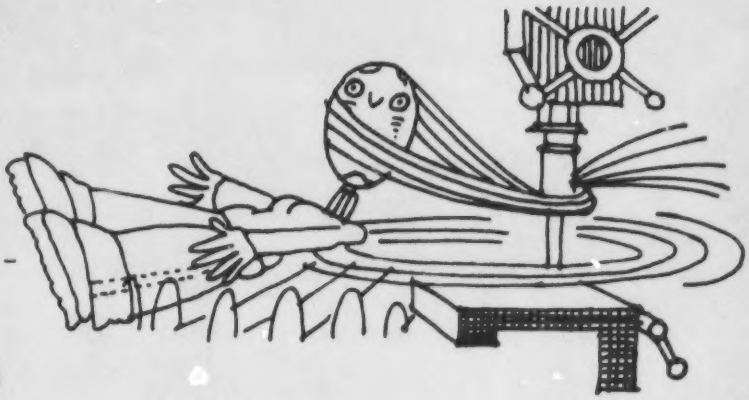
Student Name_____
Class_____
Date_____ Grade_____

SAFETY QUIZ

1.	A rag should be used to hold hot objects while buffing.	T	F
2.	Always buff on the lower half of the wheel.	T	F
3.	Loose clothing or hair must be confined.	T	F
4.	Goggles must be worn when buffing.	T	F
5.	Use extra caution when buffing corners or confined areas of the work.	T	F

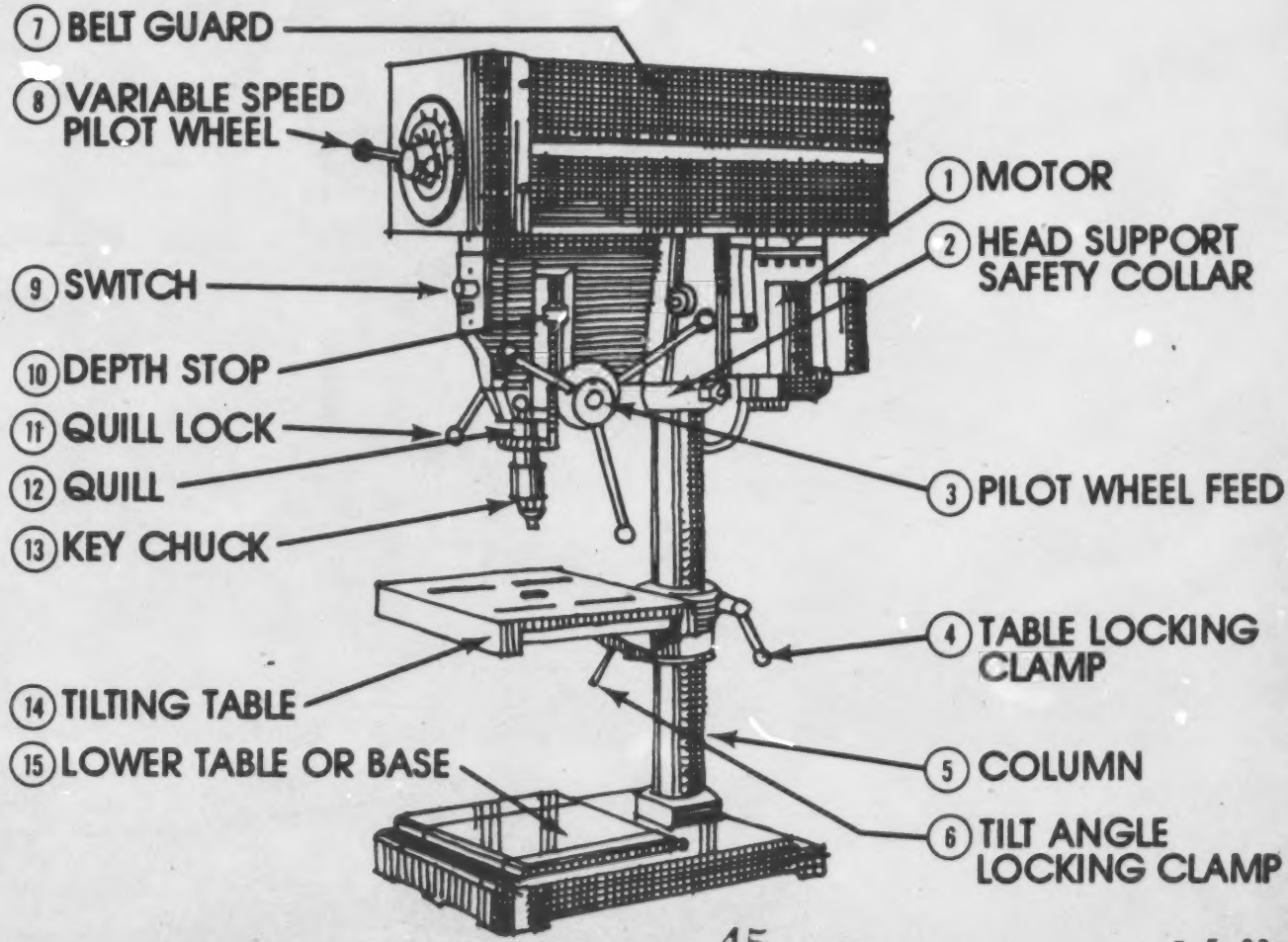
OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Drill Press



SAFETY SUGGESTIONS

1. Wear appropriate eye protection
2. Remove jewelry - eliminate loose clothing - confine long hair.
3. Operate only when all guards are in place.
4. Select properly sharpened drill bit - tighten in chuck and remove key.
5. Clamp material - check for safety - turn on power.
6. If a piece of work is caught in the drill -- turn off power -- do not try to stop by hand.
7. Select speed carefully -- the larger the drill the slower the speed.

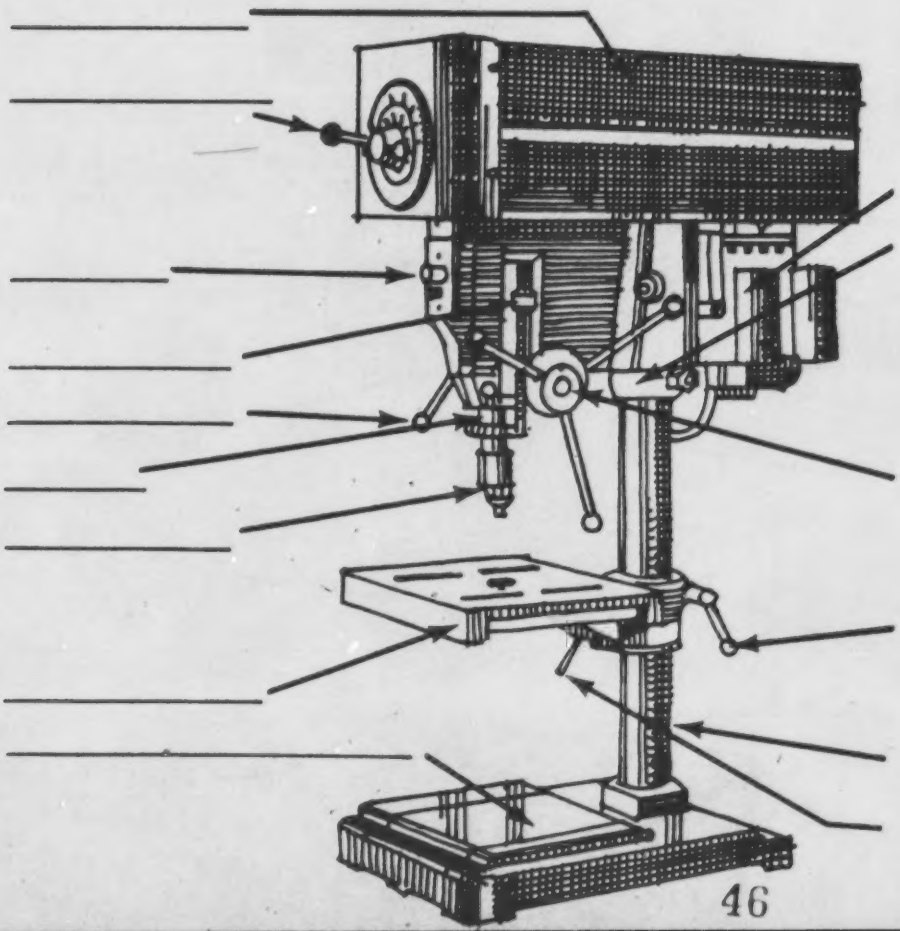


DRILL PRESS

Student Name _____
Class _____
Date _____ Grade _____

SAFETY QUIZ

1.	It is necessary to select the proper speed.	T	F
2.	The chuck key should be kept in the chuck at all times.	T	F
3.	Work should always be secured.	T	F
4.	Rings may be worn while operating a drill press.	T	F
5.	A chip brush should be used for removing chips.	T	F
6.	The drill should be operated at top speed for all work.	T	F
7.	The long end of the work should be at the left of the operator.	T	F
8.	Long hair must be confined in a hat or net, or tied back.	T	F



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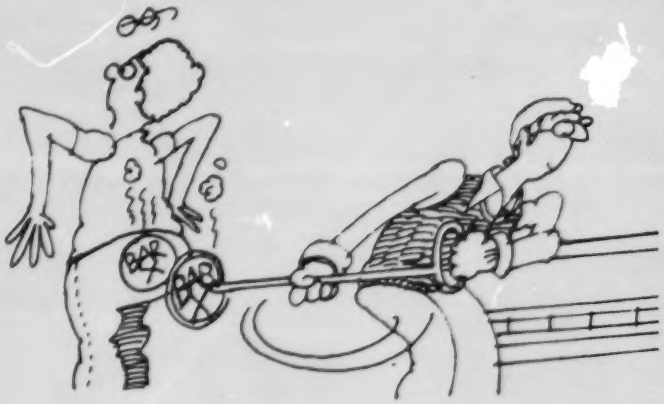
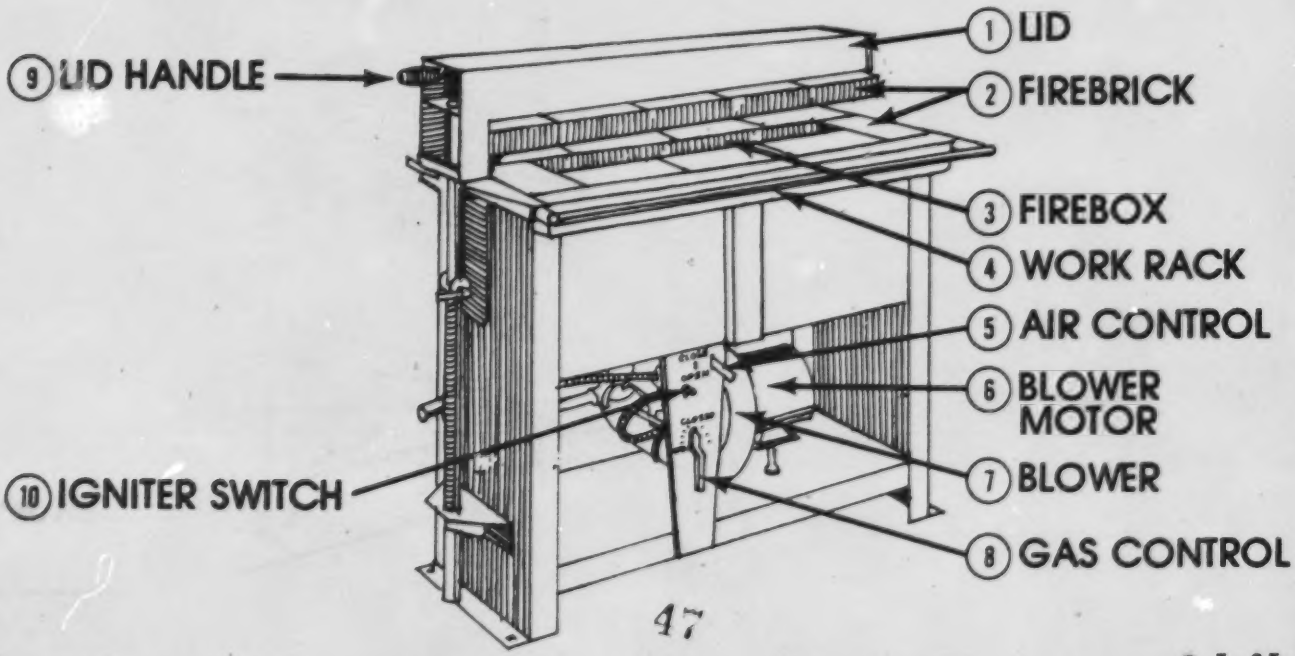
OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Gas Forge



SAFETY SUGGESTIONS

1. A face shield must be worn when operating forge.
2. Asbestos mittens (gloves) must be worn when the tongs cannot be used.
3. A pail of water should be nearby at all times.
4. Hot metal should be marked "HOT" with chalk.
5. The top must be open when lighting the forge.
6. When shutting down, the gas control should be turned off first.
7. Be sure gas is off "tight" when leaving the forge.



GAS FORGE

Student Name_____
Class_____
Date_____ Grade_____

SAFETY QUIZ

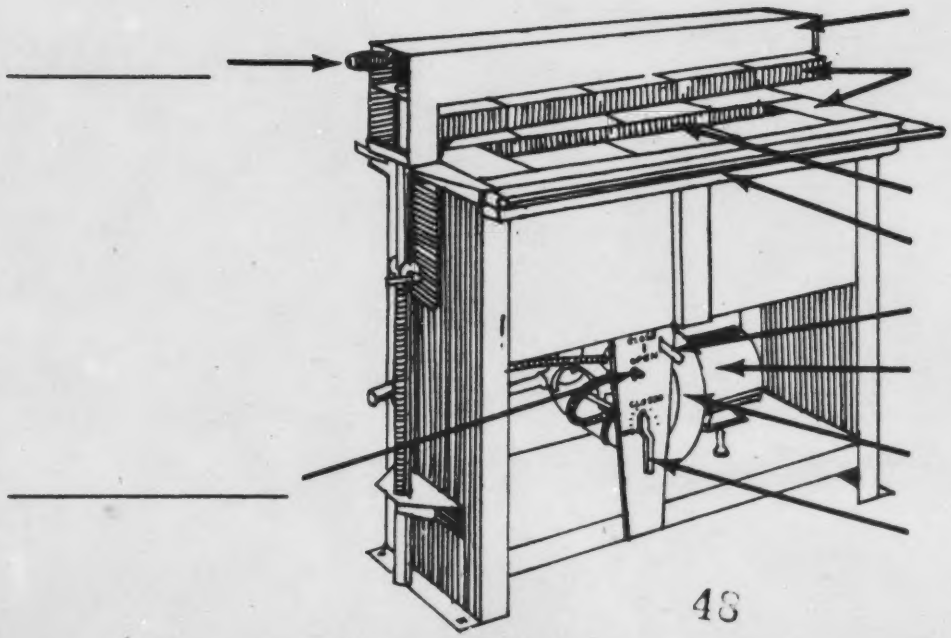
1. Tongs should be available for the handling of hot metal. T F

2. Gloves should be worn when handling the tongs. T F

3. The top slot should be closed when lighting the forge. T F

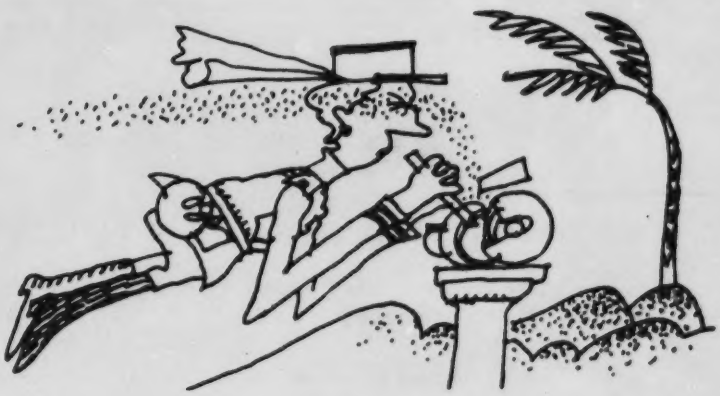
4. The air should be turned off first when shutting down. T F

5. Hot metal should be marked "HOT". T F



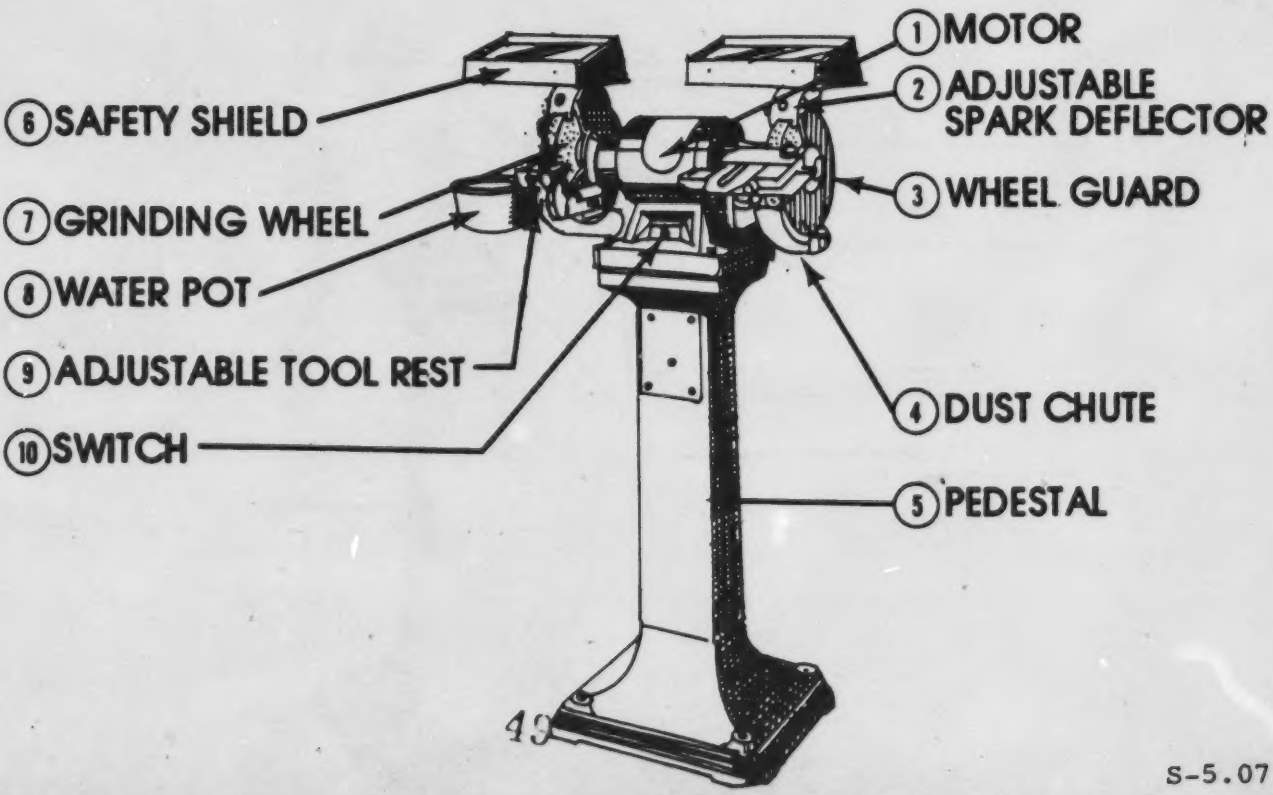
OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Grinder



SAFETY SUGGESTIONS

1. Eye protection must be worn at all times.
2. All guards must be properly adjusted.
3. The tool rest must be adjusted to 1/8" from the wheel.
4. Do not grind on the side of the grinding wheel.
5. Spark arrestor or top guard must be within 1/8" of wheel.
6. Small pieces should be held with "vise grip" type pliers.
7. A wheel that is excessively worn or cracked should be discarded.
8. The glass safety shield should be clean.
9. Stand to one side when starting the machine.



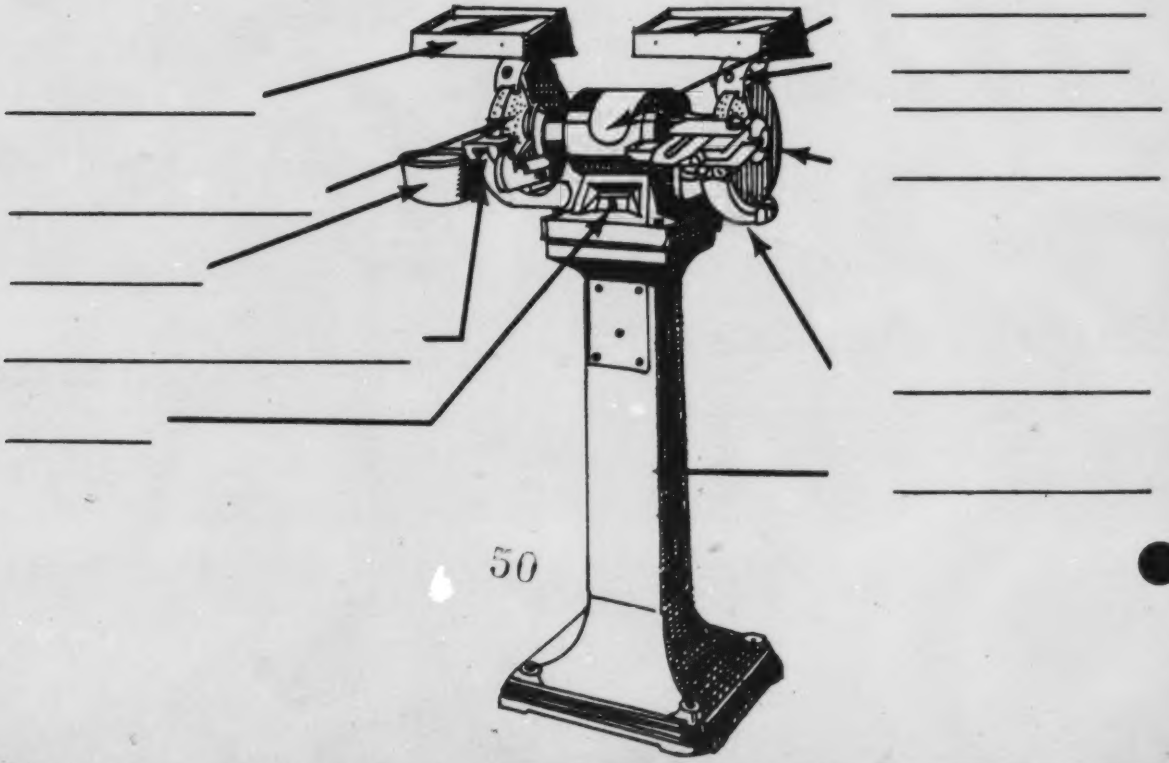
S-5.07

GRINDER

Student Name_____
Class_____
Date_____Grade_____

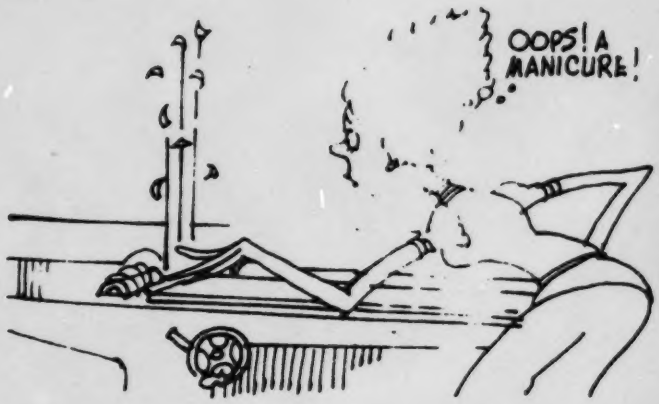
SAFETY QUIZ

1. The tool rest should be adjusted to within 1/2" of wheel. T F
2. Eye protection is not always necessary while grinding. T F
3. Once the "off" switch is in the off position, the operator may leave. T F
4. The safety shield should be clean. T F
5. Wheels that are out of balance may be used. T F
6. The spark arrestor is not necessary if there is a glass safety shield. T F
7. When grinding a small piece of steel, "vise grips" are advised. T F
8. If there is a glass shield, eye protection is not required. T F



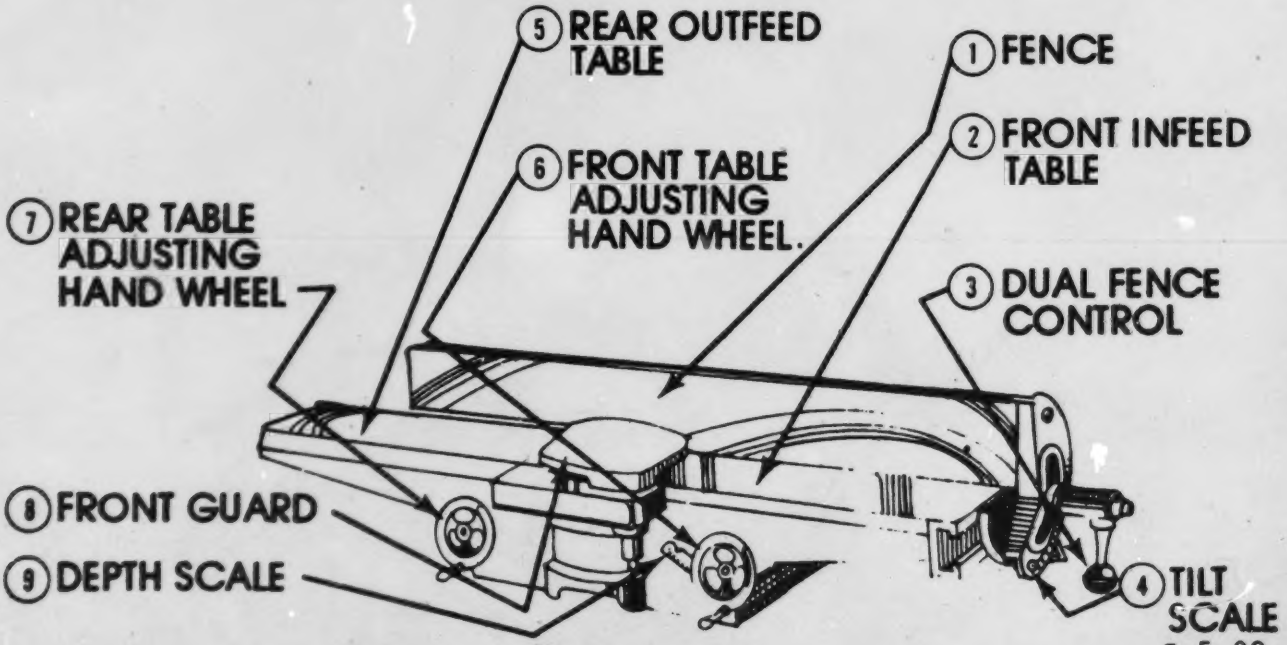
OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Jointer



SAFETY SUGGESTIONS

1. Before starting, make sure that guards are free and will cover the blade at all times.
2. A push stick must be used on all material that would bring the hands within 2" of the cutter.
3. An assistant should help support long pieces.
4. Several light cuts are safer than one heavy cut.
5. Wear eye protection.
6. The board being jointed must exceed the minimum length established for that particular machine (check with instructor).



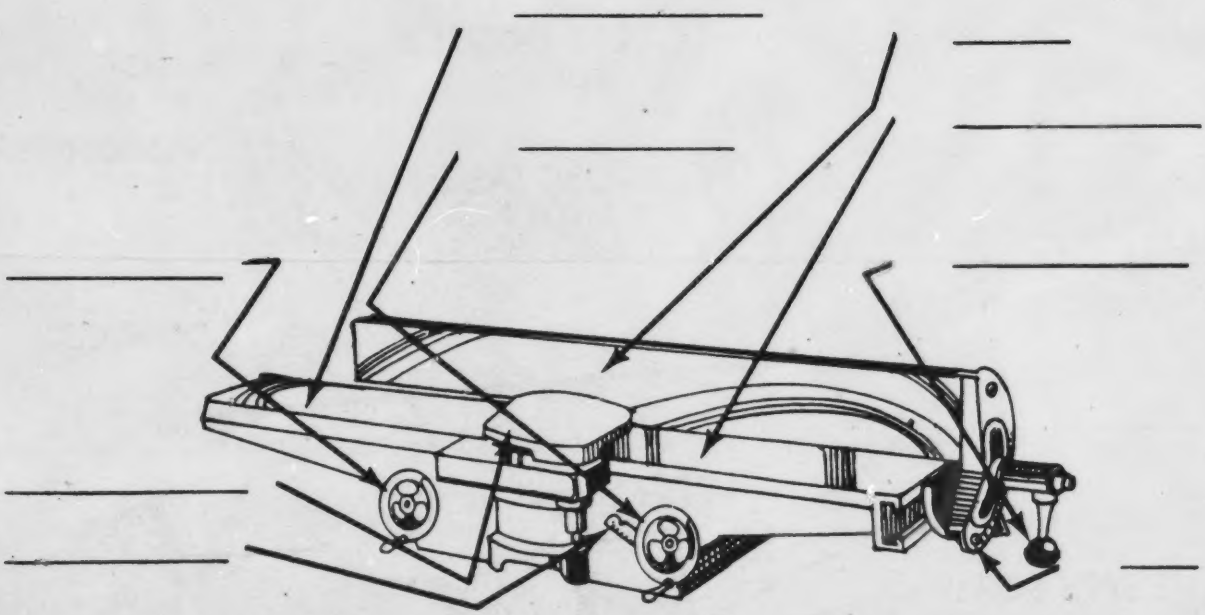
S-5.09

JOINTER

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

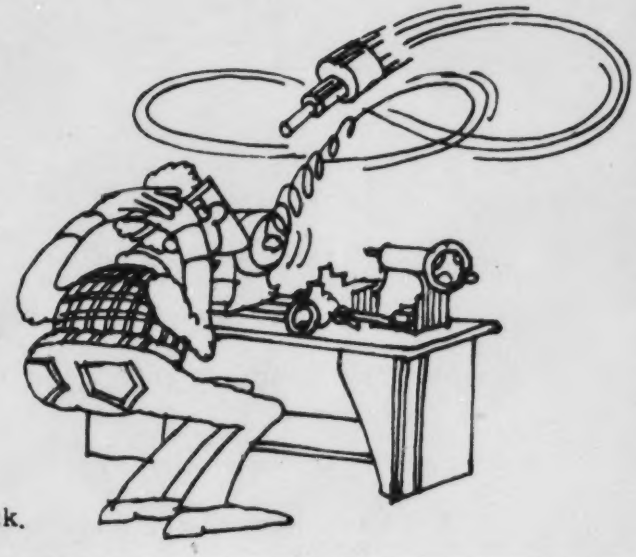
1. It is possible for the guard to stick and not cover the cutter. T F
2. A push stick should be used when the hands could get close to the cutter. T F
3. Eye protection is not necessary when operating a jointer. T F
4. Permission should be obtained before using the jointer. T F
5. Stock shorter than 6" may be processed on the jointer. T F



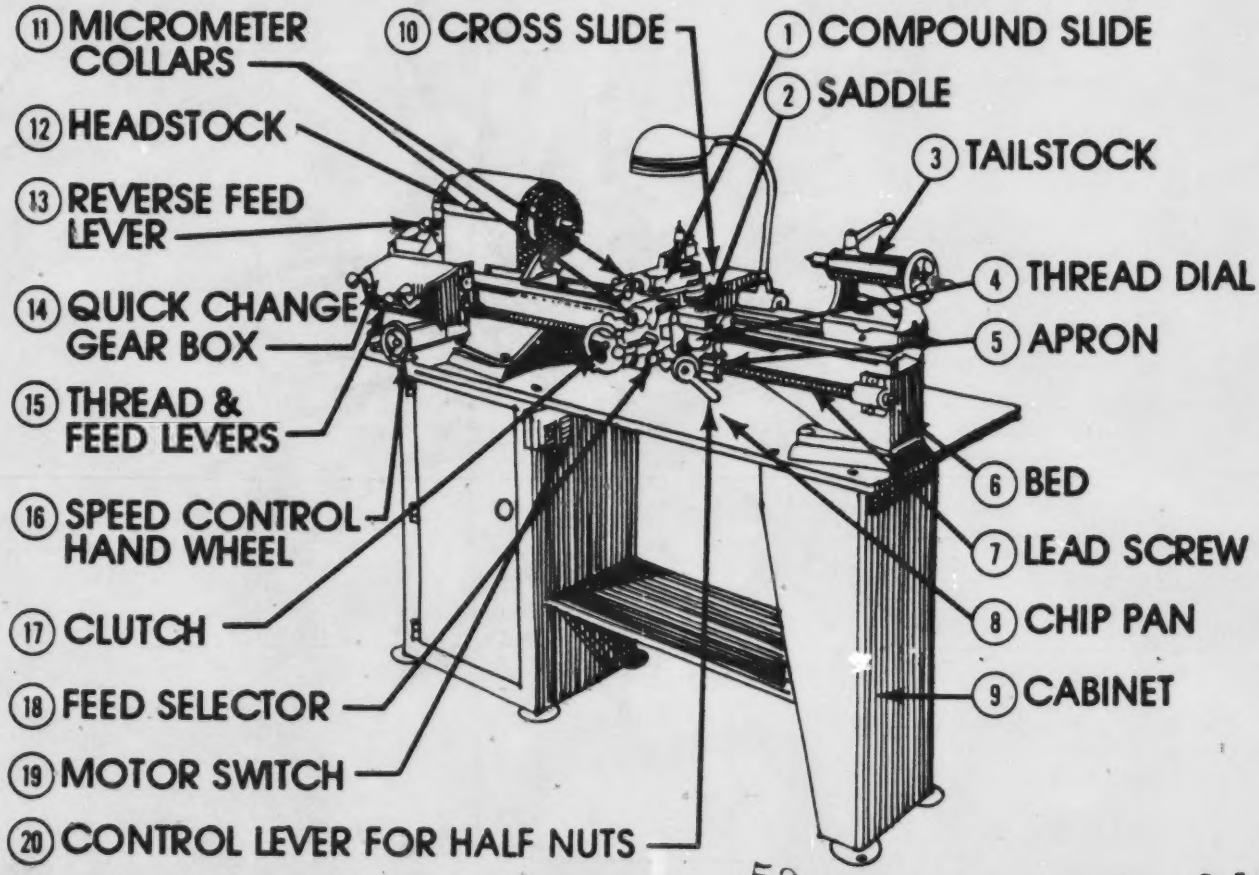
OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Metal Lathe

SAFETY SUGGESTIONS



1. Wear appropriate eye protection.
2. Remove jewelry, eliminate loose clothing and confine long hair.
3. Do not leave the machine until it has stopped.
4. A brush should be used to remove chips.
5. The chuck should be turned by hand before starting.
6. Never leave chuck wrench in chuck.
7. Stock should be balanced and secured before starting.
8. Operate at the correct speed for the job.
9. Handle chucks with care; keep hands away from moving parts and work.



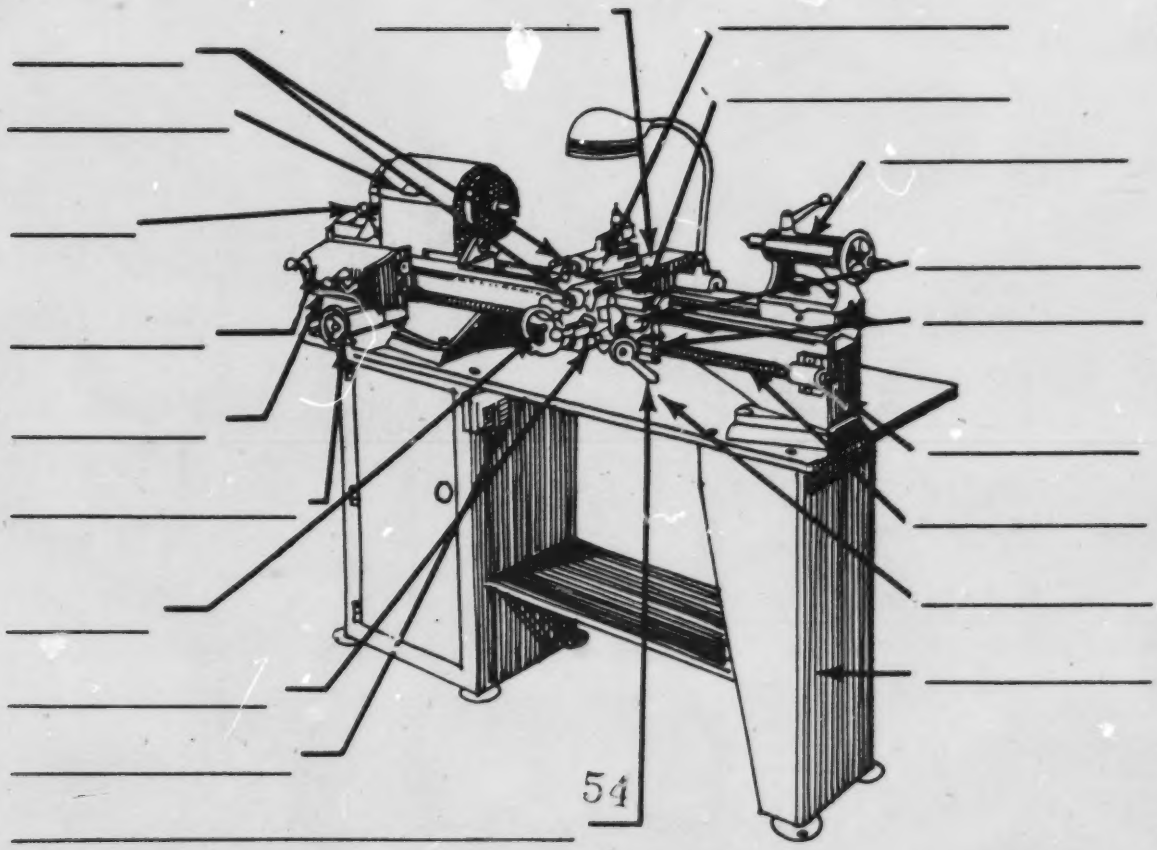
S-5.11

METAL LATHE

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1. A brush should be used for removing chips. T F
2. The tail stock need not be secure to the bed. T F
3. The chuck wrench remains in the chuck when the machine stops. T F
4. It is safe to turn machine by hand before starting. T F
5. Measurements should be made while the machine is stopped. T F

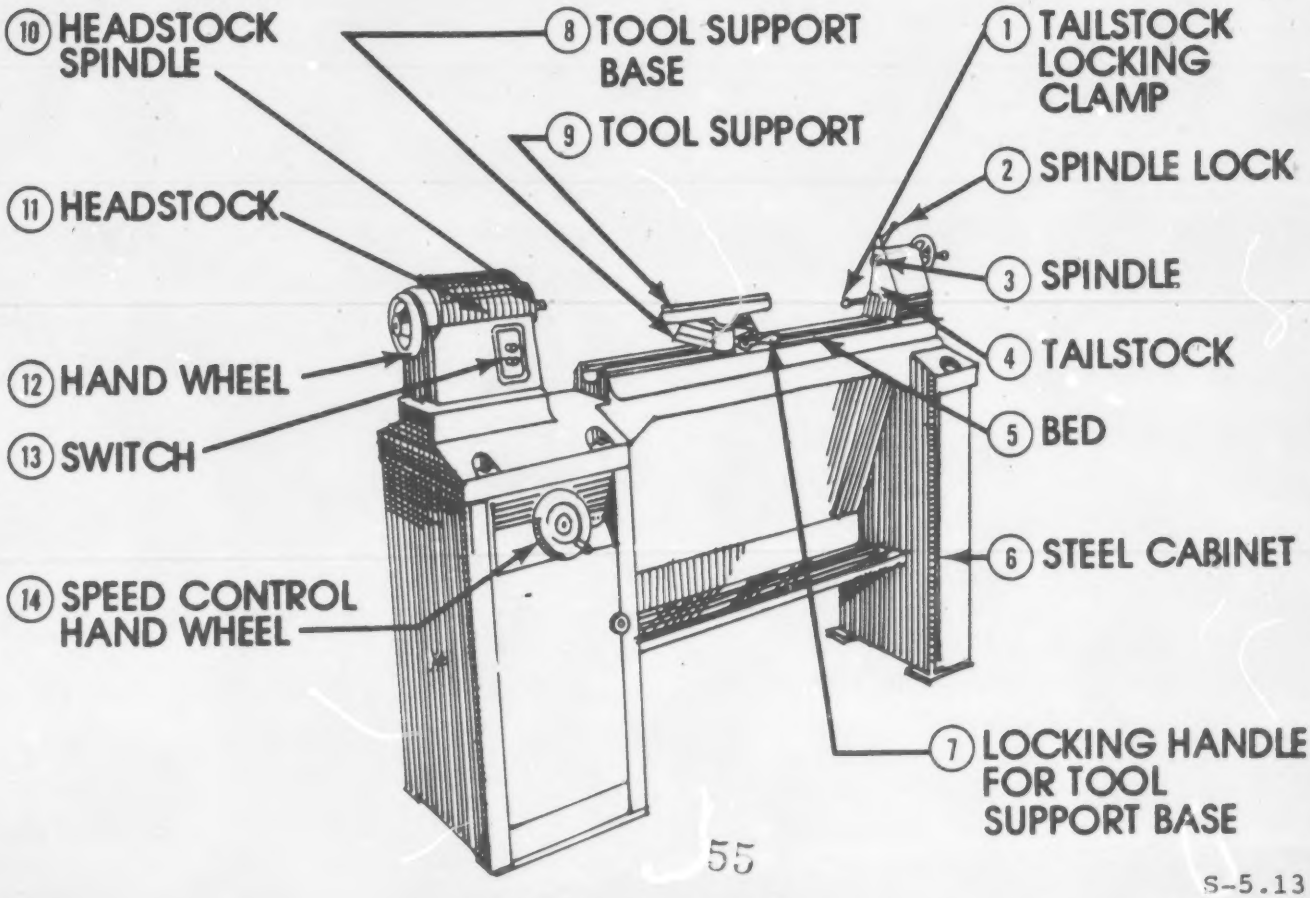


OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Wood Lathe

SAFETY SUGGESTIONS

1. Eye protection must be worn.
2. The tool rest must be close to the work when cutting tools are being used.
3. The cutting tools must be kept sharp.
4. Do not feel for smoothness of work while machine is running.
5. Work must be centered, balanced and secured.
6. The tool rest must be removed while sanding.
7. Examine setup before turning on power.
8. Shut off power while cleaning machine.
9. Long hair and loose clothing must be appropriately confined.



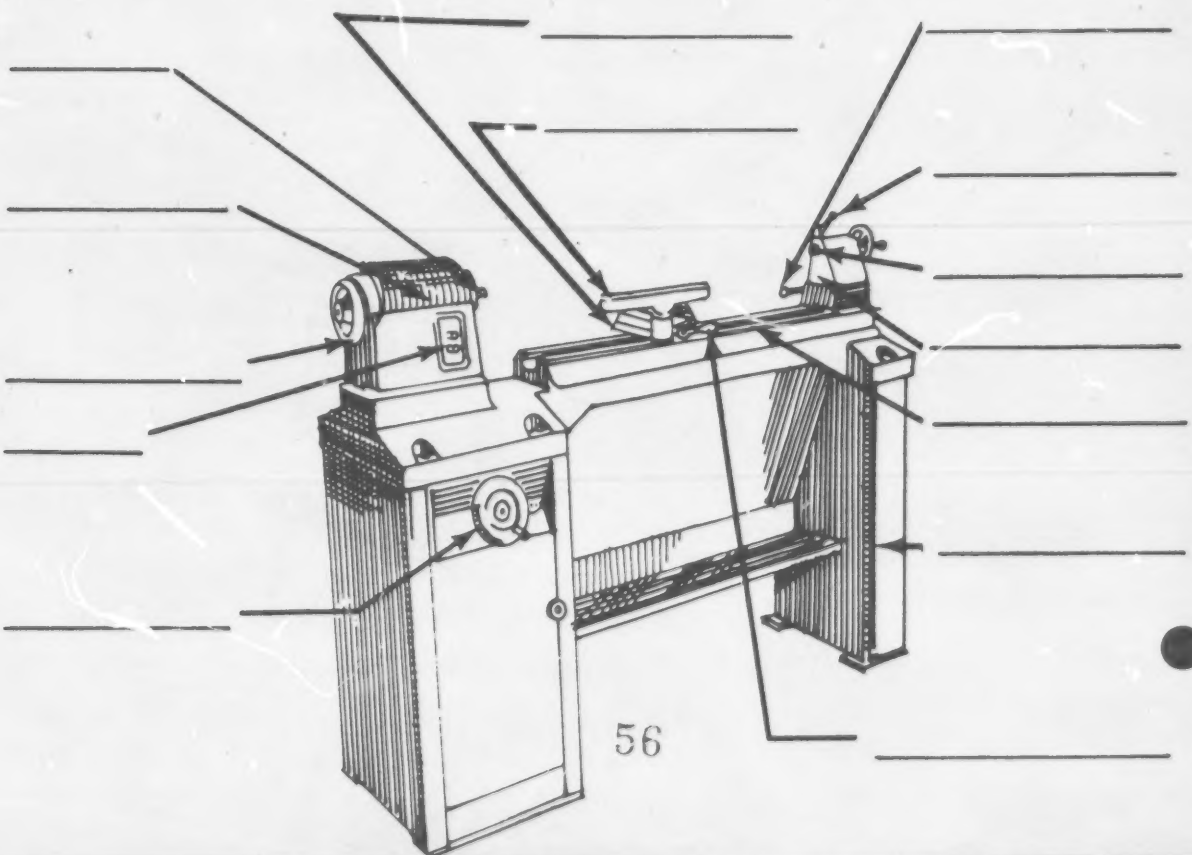
S-5.13

WOOD LATHE

Student Name_____
Class_____
Date_____ Grade_____

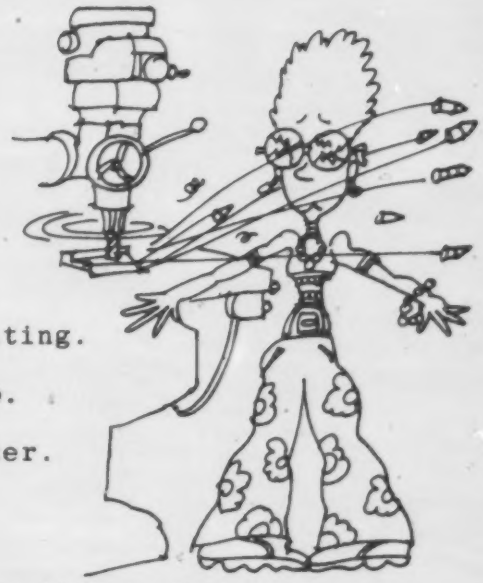
SAFETY QUIZ

1. The speed of the machine is not important for safe operation. T F
2. A space of 1" is safe between the tool rest and the work. T F
3. Eye protection is not necessary during operation. T F
4. Dull tools may be used. T F
5. It is safe to feel for smoothness while turning. T F
6. The tool rest should be removed while sanding. T F
7. It is safe to turn work that is not balanced. T F
8. Long sleeves may be worn while operating. T F
9. The cutting tools should be held loosely. T F
10. The hair should be confined while operating the machine. T F



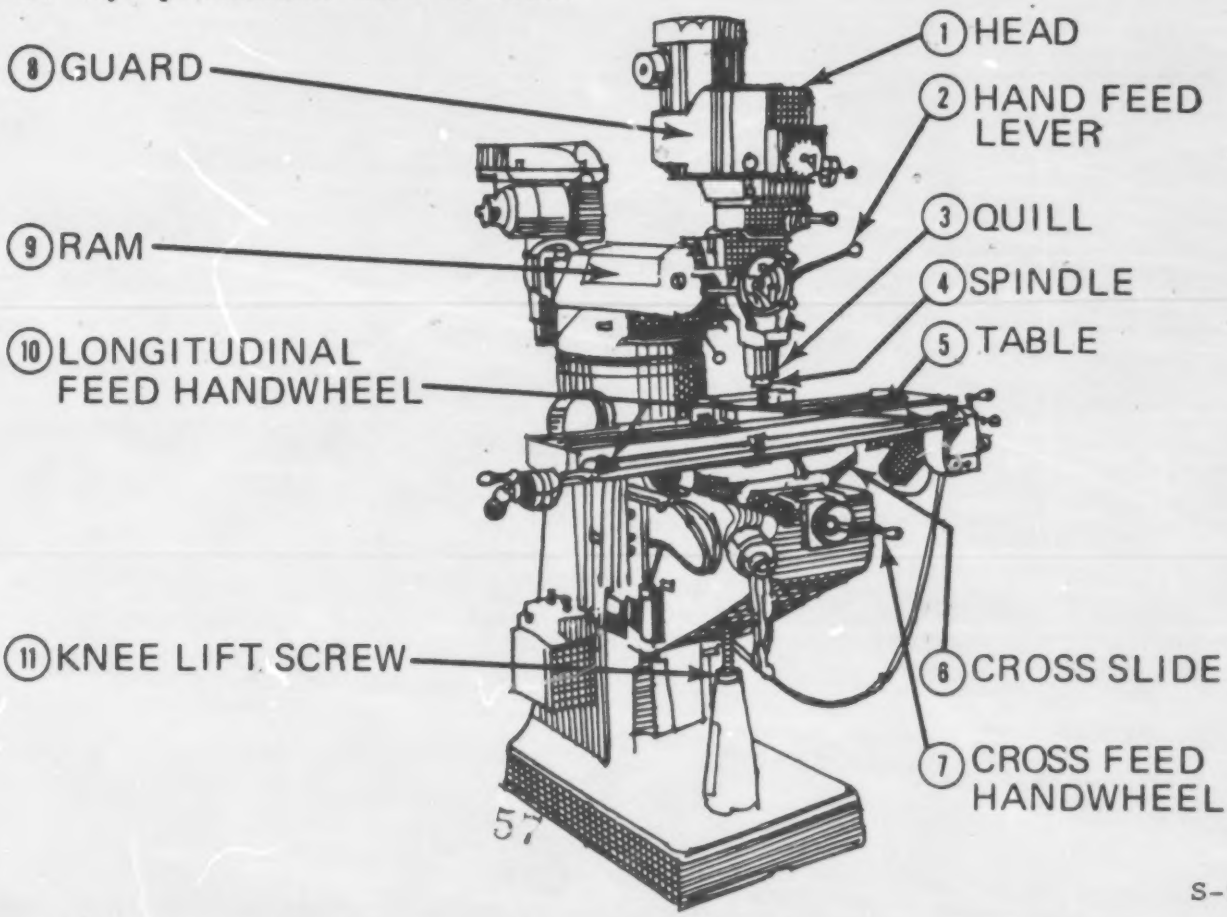
OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Milling Machine



SAFETY SUGGESTIONS

1. Make adjustments and measurements only when the machine is at a complete stop.
2. Material being machined must be properly secured.
3. Make sure the cutter is rotating in the right direction. Feed against the cutter unless the machine is capable of climb cutting.
4. Handle cutters carefully as they are sharp.
5. Keep fingers a minimum of 6" from the cutter.
6. Take care to prevent jamming the vise or the work into the column, cutter, etc.
7. Start your own machine and remain with it until you have turned it off and it has come to a complete stop.
8. Never clean chips away from cutter while machine is running.
9. Eye protection must be worn.



MILLING MACHINE

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1. On long cuts it is permissible to leave the machine while on automatic feed. T F

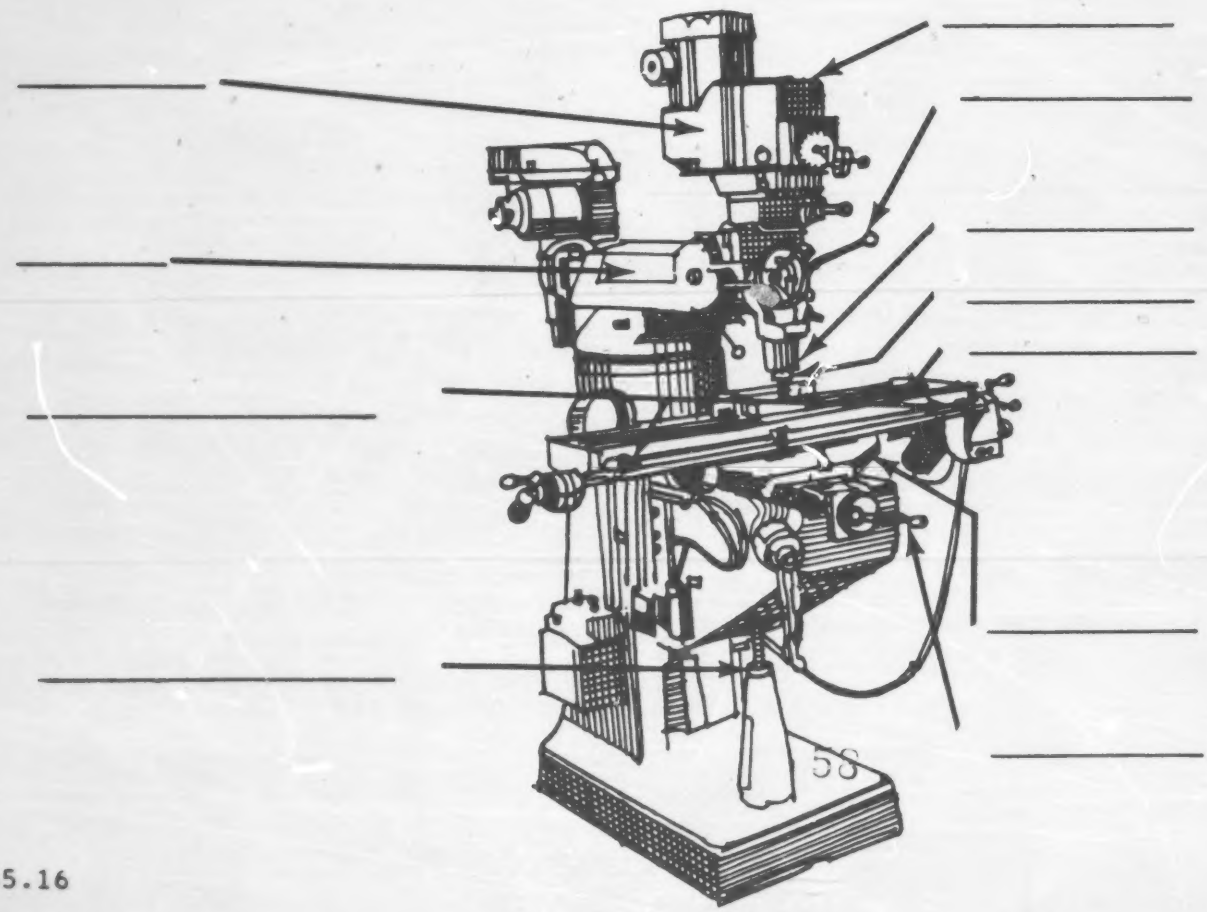
2. Cutters should be stored loosely on the work bench. T F

3. Eye protection should be worn at all times. T F

4. Swarf chips can be wiped away with the hands. T F

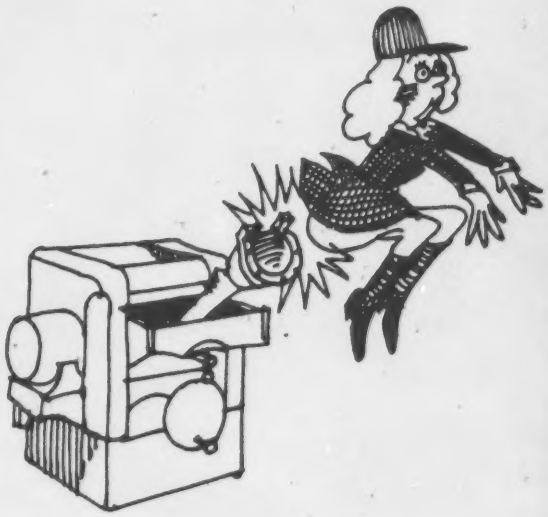
5. The automatic rapid feed should not be used when the stock is closer than 6" from the cutter. T F

6. Handles should be disengaged when on automatic feed. T F



OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Planer-Surfacer



SAFETY SUGGESTIONS

1. Appropriate eye protection must be worn.
2. A "backer board" should be used when planing thin stock.
3. Do not force material through planer.
4. Do not remove chip accumulation while machine is running.
5. Do not stand directly behind the machine or in the line of kick back.
6. Do not look into the throat of the surfacer when it is running.
7. Be sure to select the proper speed and depth of cut.
8. The board being surfaced must exceed the minimum length established for that particular machine (check with instructor).

PLANER-SURFACER

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1. Instructor's permission is required to operate the machine. T F

2. Eye protection is required to operate machine. T F

3. Chips may be removed while machine is running. T F

4. It is safe to plane wood with loose knots. T F

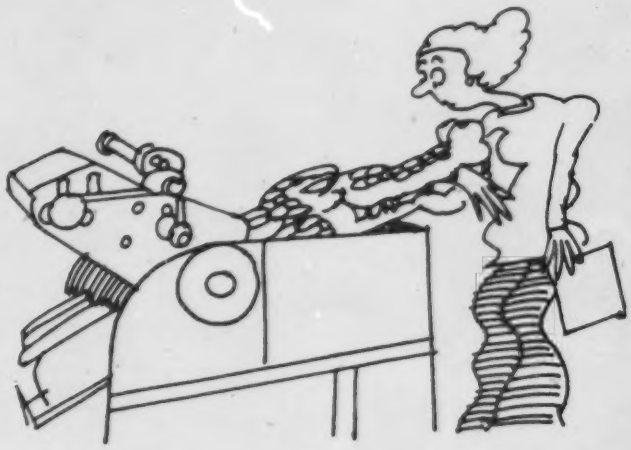
5. If material becomes stuck, it is safe to stop machine. T F

6. Line of sight should be through the throat of the machine. T F

7. Assistance should be obtained when planing long pieces of wood. T F

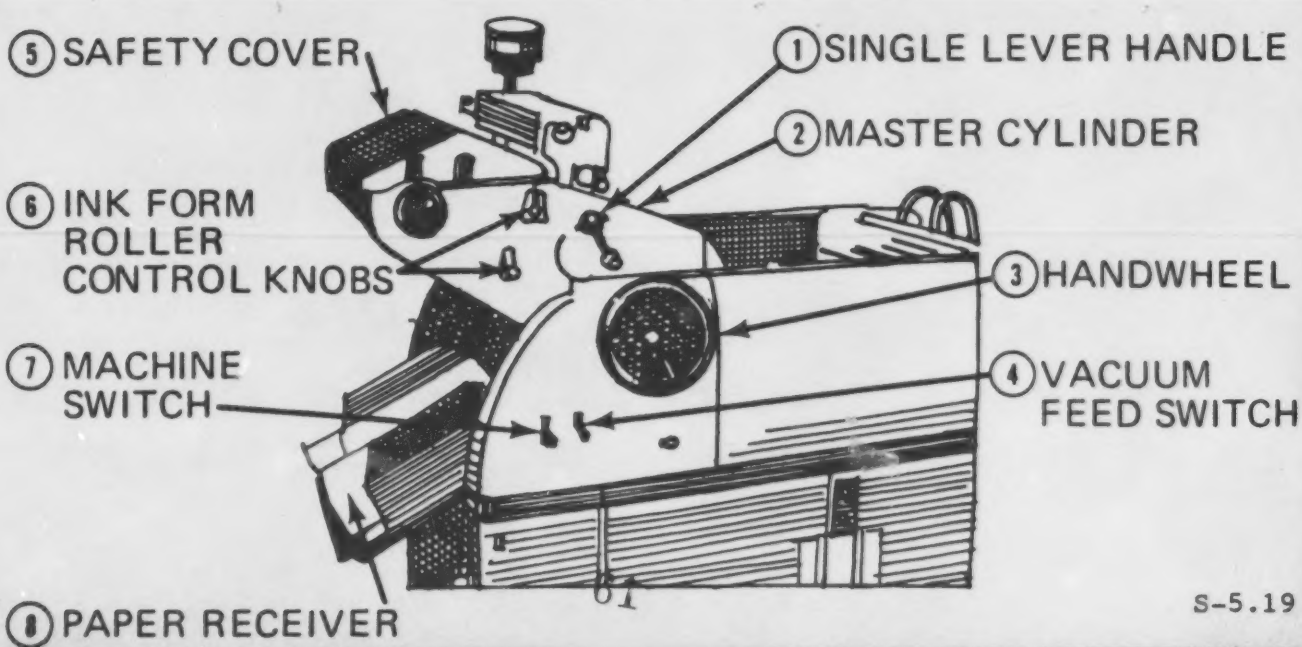
OBTAIN PERMISSION
FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Offset Printing Press



SAFETY SUGGESTIONS

1. Operate the press only when all guards are in place and properly adjusted.
2. Never reach for misprinted or dropped paper while the press is in operation.
3. Do not make internal adjustments while the press is in operation.
4. Do not clean the press while it is in operation.
5. The instructor should determine the operating speed.
6. Never reach across the press while it is in operation.
7. When finished with the press, it must be clean and all paper, equipment and tools must be returned to proper storage.



S-5.19

OFFSET PRINTING PRESS

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

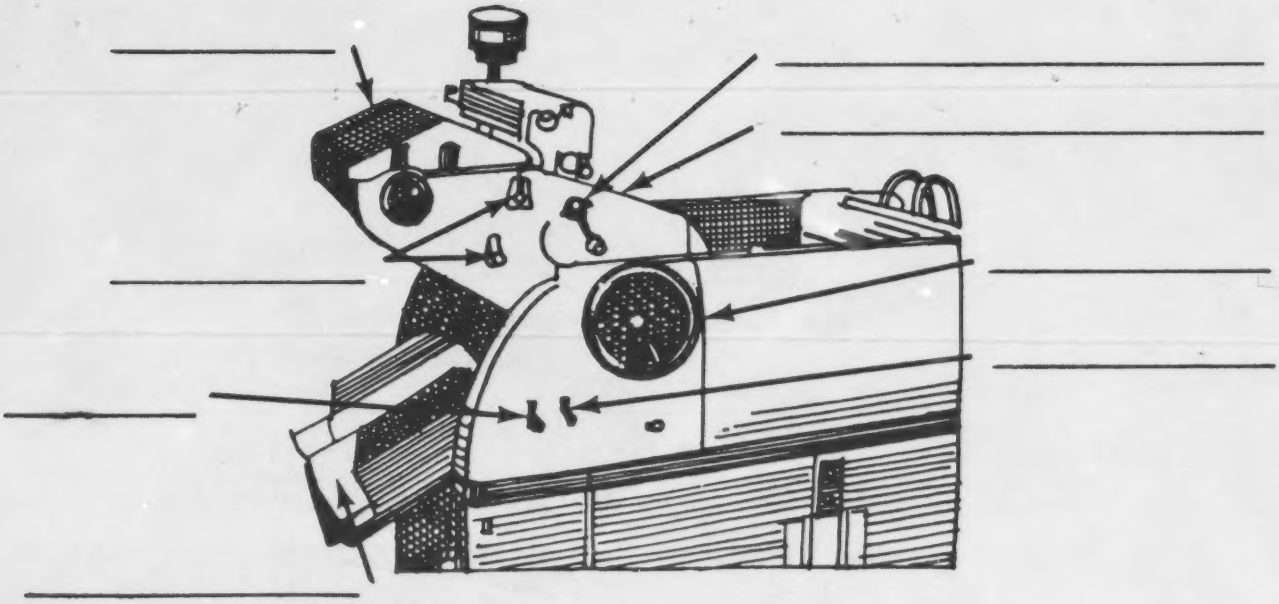
1. The gears need not be covered while the press is in operation. T F

2. The machine must be stopped before misprinted or dropped paper is removed from the press. T F

3. Final adjustments may be made while the machine is running. T F

4. You should be alert to keeping others away from the press while it is in operation. T F

5. It is safe to reach across the press when it is operating. T F

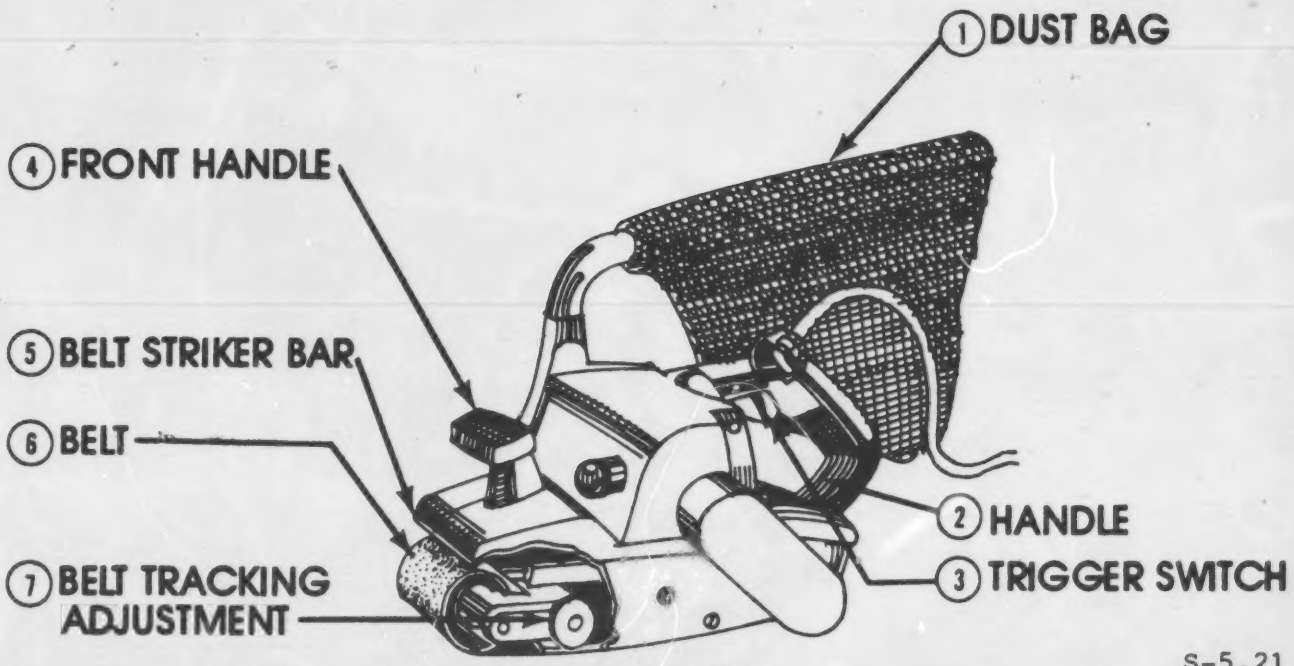


OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Belt Sander

SAFETY SUGGESTIONS

1. Wear appropriate eye protection.
2. Check to see if belt is properly installed and in good condition before starting.
3. Start sander above work; let rear of belt touch first.
4. Keep the electrical cord clear and the dust bag away from the sander belt.
5. Lift sander off the work before stopping.
6. Wait until belt is completely stopped before placing sander on bench.
7. Empty dust bag daily into proper waste container.



S-5.21

BELT SANDER

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

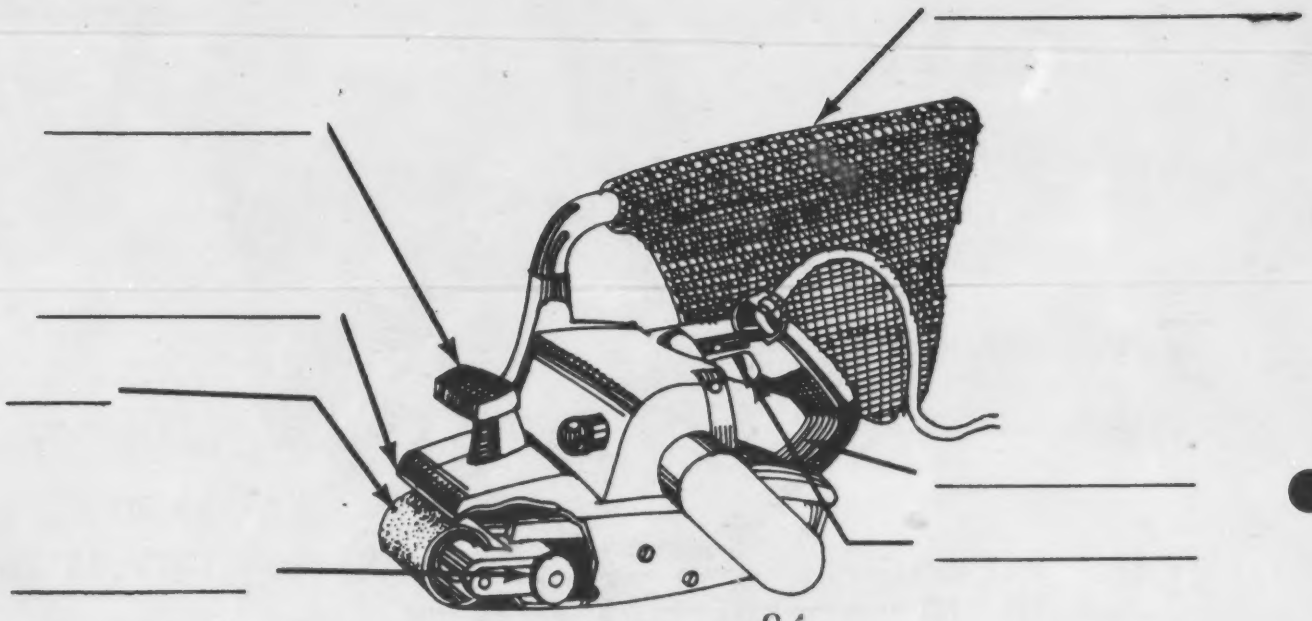
1. Eye protection is required when using this machine. T F

2. You should have a firm grasp on the sander before starting. T F

3. The sander should rest on the work when starting. T F

4. A wood sander should not be used on steel. T F

5. This machine should be examined before starting. T F



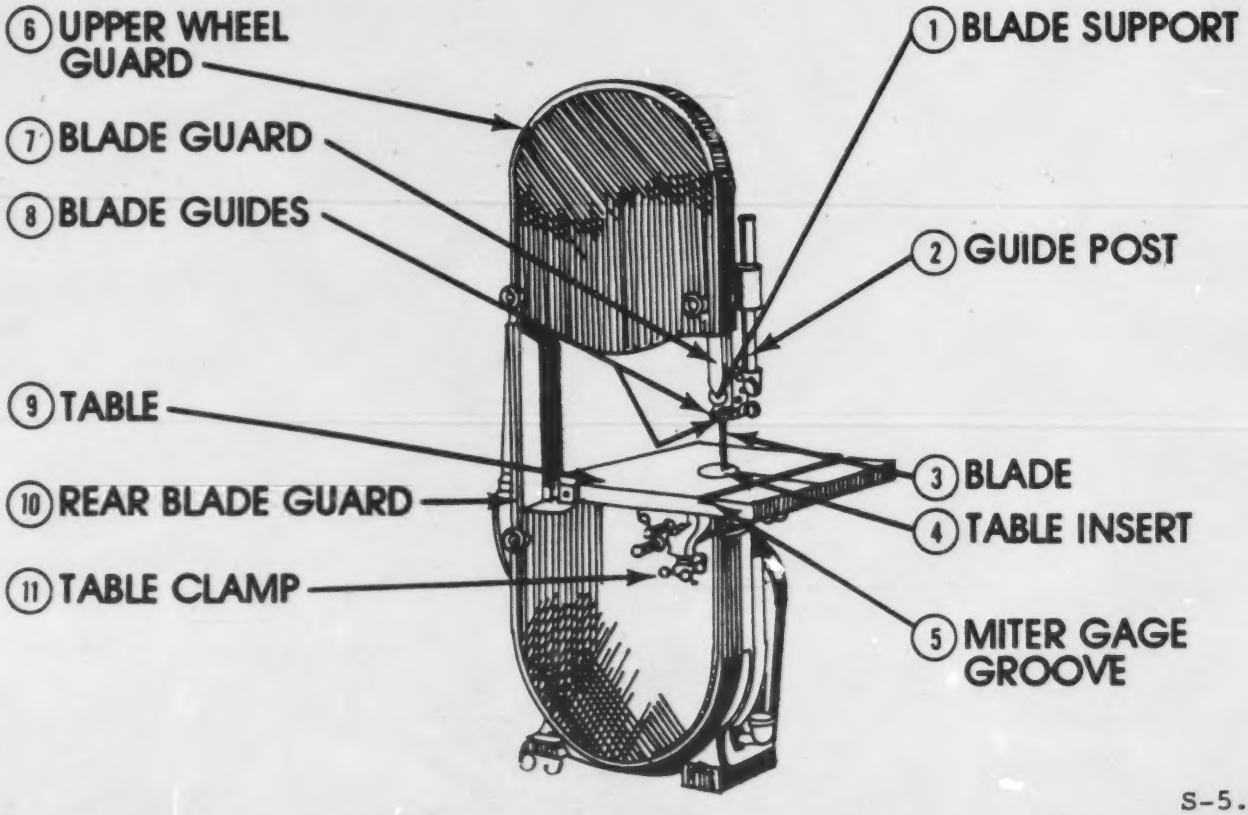
S-5.22

OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Band Saw

SAFETY SUGGESTIONS

1. Wear appropriate eye protection.
2. Remove jewelry, eliminate loose clothing and confine long hair.
3. Use properly secured and adjusted guards at all times.
4. Adjust the guide and guard to within 1/4 inch of work.
5. Remove scrap only when machine is stopped.
6. Avoid backing out of a cut (kerf).
7. Keep hands and fingers in such a position that there is no danger of their slipping into the blade. Hold work piece on either side of the cutting line. Use a push stick where necessary.
8. Do not leave the machine until it has stopped.
9. Consult with your instructor before cutting large or irregular shaped pieces.

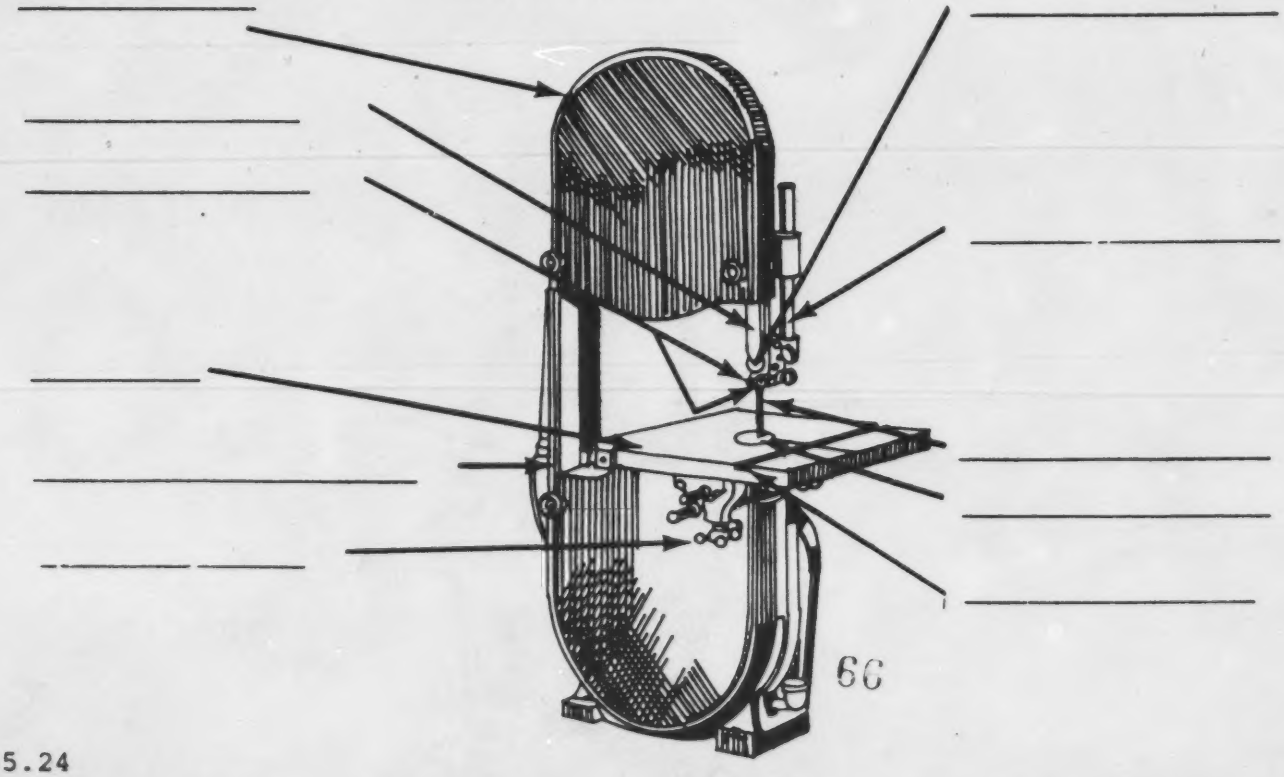


BAND SAW

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1. It is safe to tilt the table for cutting bevels. T F
2. The lower band wheel does not require a guard. T F
3. The saw should be stopped by forcing a piece of wood against the blade. T F
4. The blade guard should be adjusted to about 1/4" from the work. T F
5. It is safe to use the fence for cutting several pieces of wood to the same length. T F
6. The hands should come no closer than 2" from the blade. T F
7. The blade guides should be adjusted tight against the blade. T F
8. Instructor's permission is required to operate a band saw. T F
9. Adjustments should be made with the power off. T F
10. Eye protection is not required when operating a band saw. T F
11. If the work does not cut easily you should:
    (a) speed up the blade
    (b) push harder
    (c) replace the blade
    (d) check with your instructor

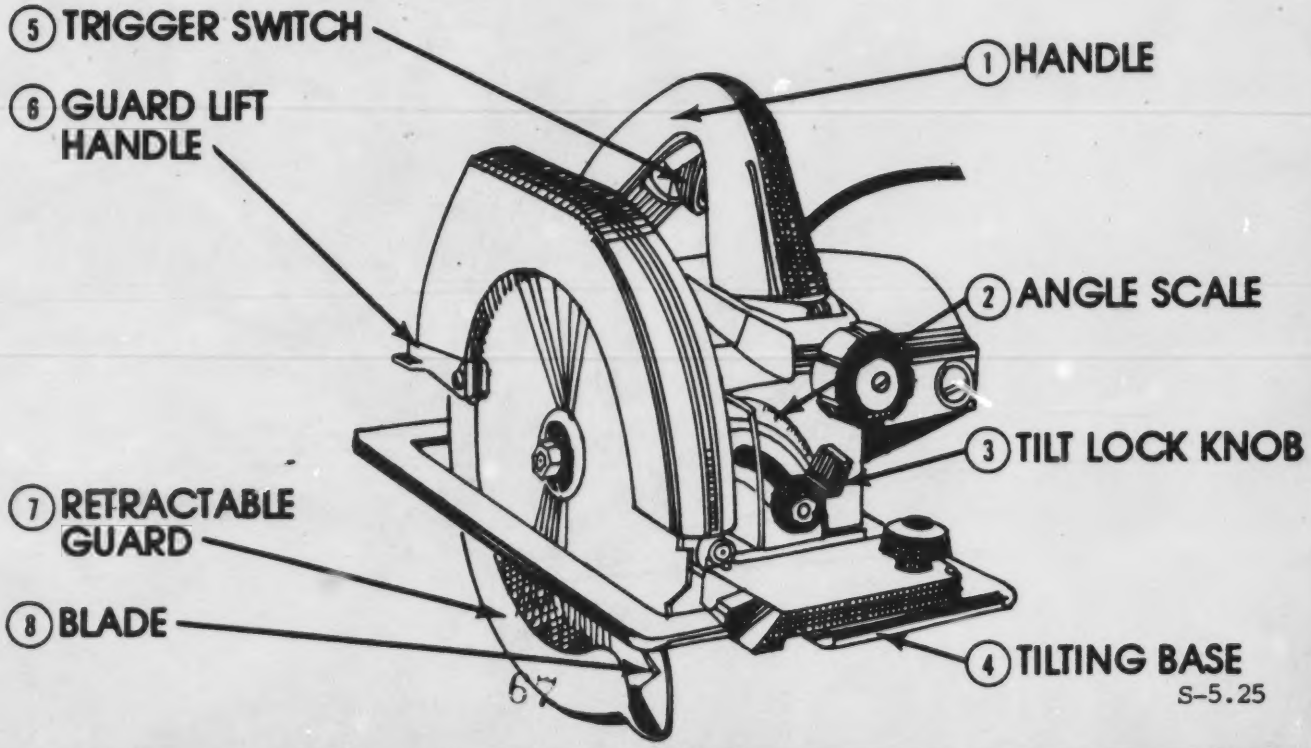


OBTAIN PERMISSION
FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Portable Circular Saw

SAFETY SUGGESTIONS

1. Make sure that telescoping guard returns automatically to cover the blade after each cut.
2. Do not set saw down until blade stops.
3. Eye protection must be worn while using saw.
4. If the saw blade binds or smokes, stop cutting immediately.
5. Make sure the power cord is clear of the blade.
6. Be sure the material you are cutting is adequately supported.
7. Remove tie, rings and watch, and roll up sleeves.
8. Check the base setting for the proper depth of cut.



S-5.25

PORTABLE CIRCULAR SAW

Student Name _____
Class _____
Date _____ Grade _____

SAFETY QUIZ

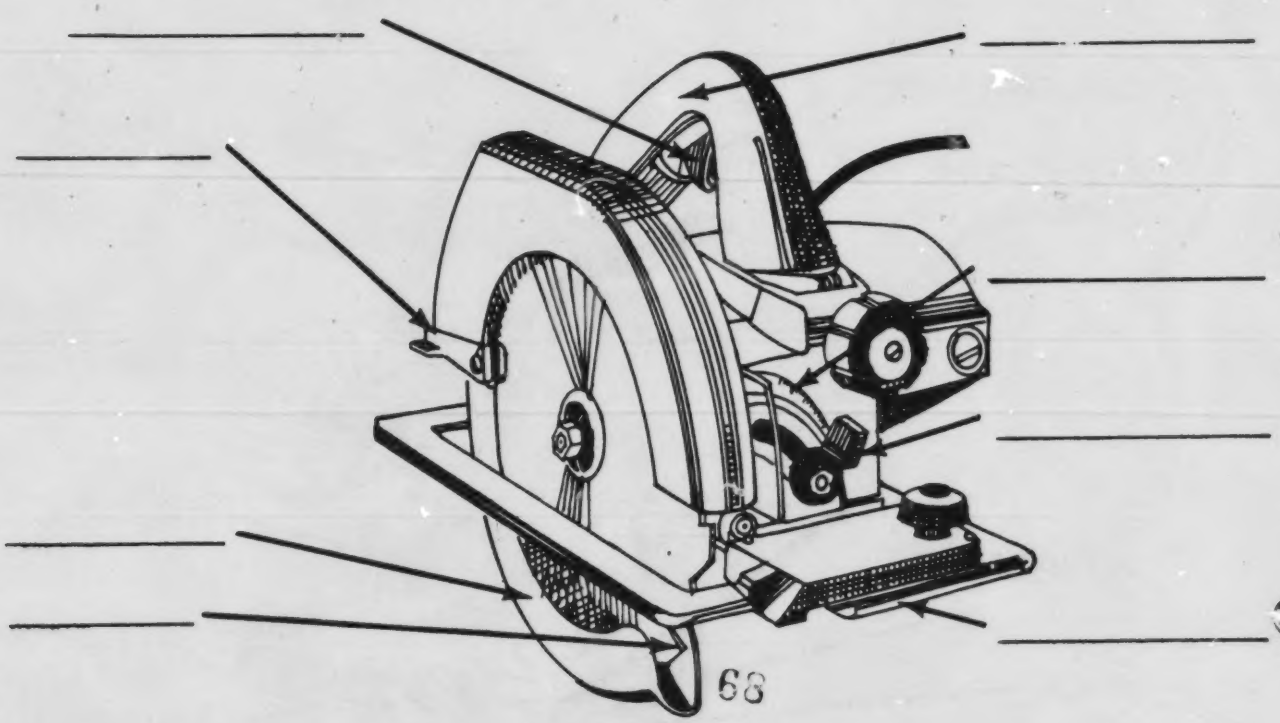
1. Permission should be obtained before operating this machine. T F

2. The guard can be wedged so that it will not be operable. T F

3. Eye protection is not necessary when using this machine. T F

4. You should not set the saw down until it has completely stopped. T F

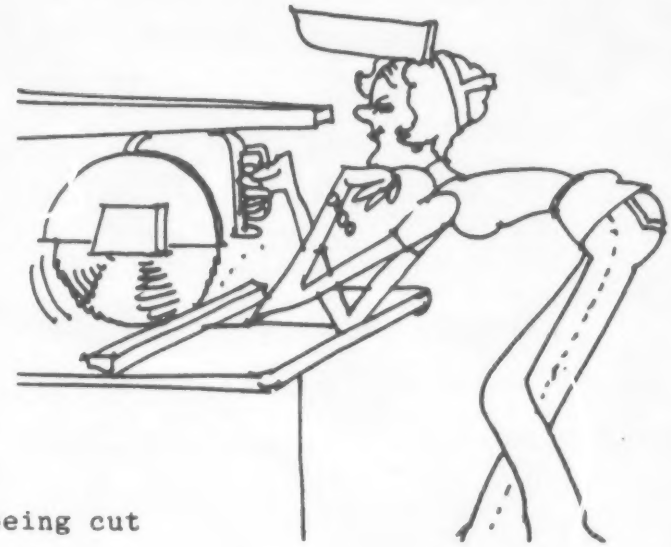
5. The saw blade should extend about 1/8" beyond the thickness of the material being cut. T F



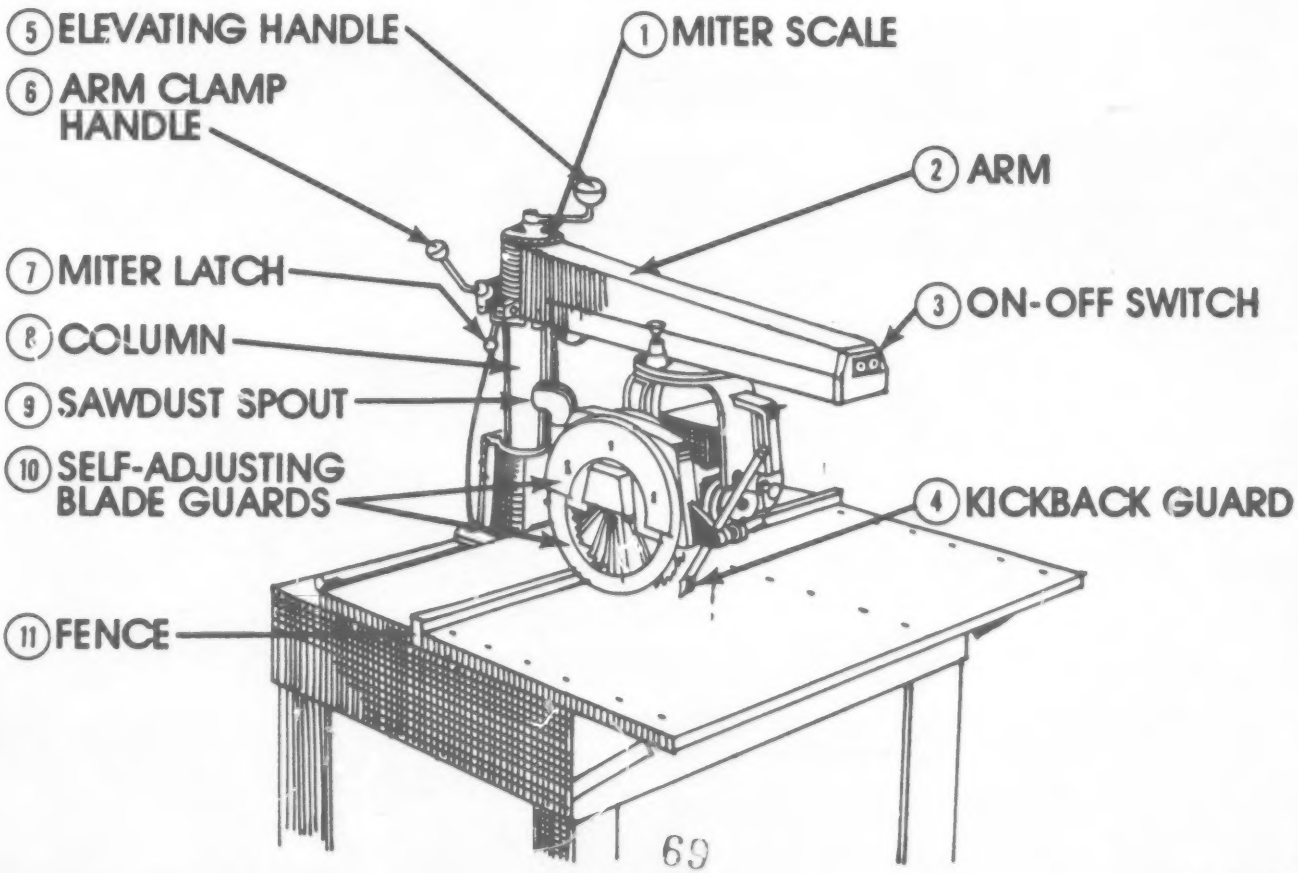
OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Radial Arm Saw

SAFETY SUGGESTIONS



1. Be sure that the saw travels easily on the arm.
2. Be sure that the blade will not extend beyond the front of the table.
3. Before starting make sure that the guard telescopes properly.
4. Make sure that the blade is stopped before leaving the machine.
5. Make sure that the material being cut is tight against the fence.
6. Eye protection must be worn while operating this machine.
7. Be sure the saw returns to the rear of the table at the completion of the cut.

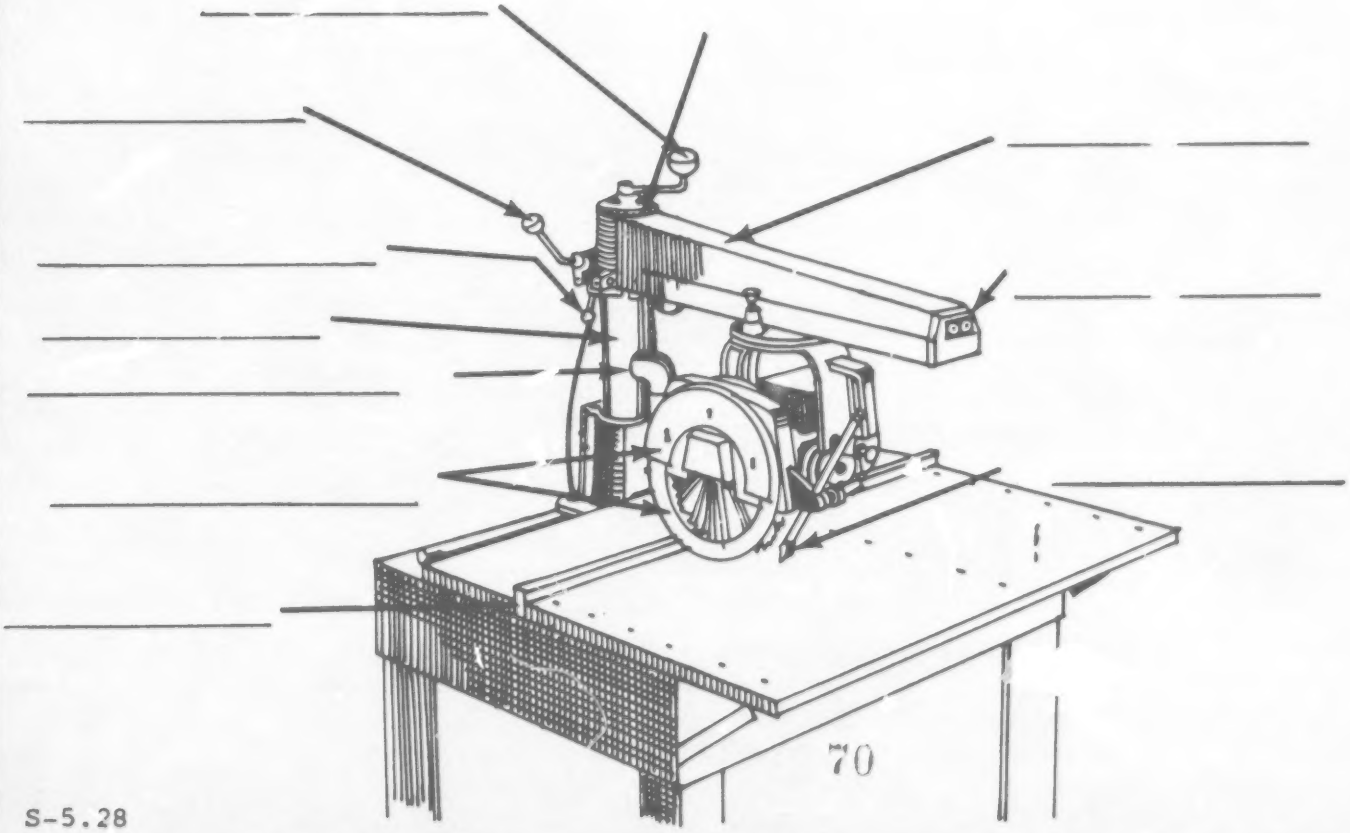


RADIAL ARM SAW

Student Name _____
Class _____
Date _____ Grade _____

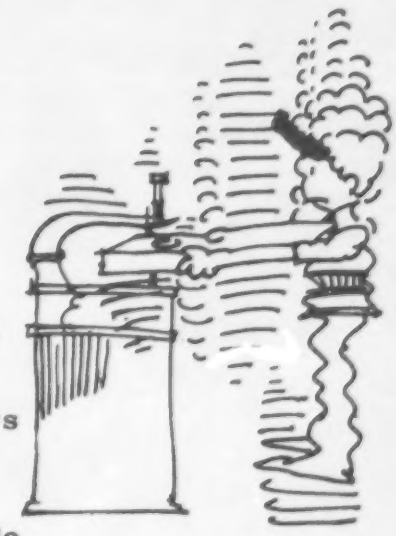
SAFETY QUIZ

1.	Eye protection is not necessary except when ripping.	T	F
2.	You may leave the machine as soon as you have pushed the "off" switch.	T	F
3.	The guard must be in place when ripping.	T	F
4.	The saw blade may extend beyond the table.	T	F
5.	The blade should be installed so that in cross cut position the teeth at the bottom of the blade point away from the operator.	T	F
6.	When ripping, one hand must hold the material and the other hand operate the saw.	T	F
7.	In cross cutting, the saw should automatically return to the rear of the radial arm upon the completion of a cut.	T	F



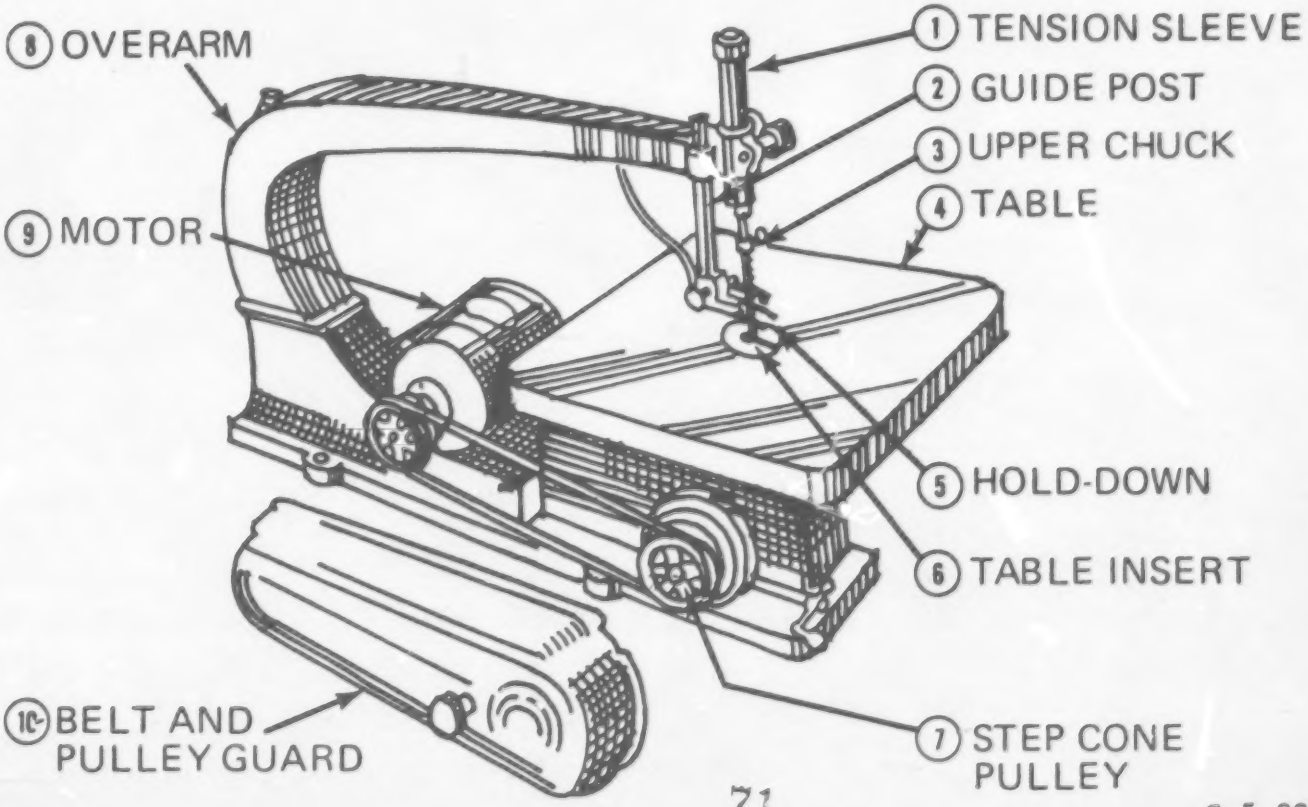
OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Scroll Saw



SAFETY SUGGESTIONS

1. Eye protection must be worn while operating this machine.
2. Make all adjustments before turning on scroll saw.
3. Lower the hold-down so that the spring fingers bear lightly on the work.
4. The danger area is within the "line of cut". Hold work piece with both hands on either side of the "saw line".
5. Shut off power and clean the machine before you leave it.
6. Avoid overloading the machine by feeding the stock too fast.
7. Avoid pinching the blade by turning too sharply.



SCROLL SAW

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1. If the blade pinches in the kerf do not stop the machine. T F

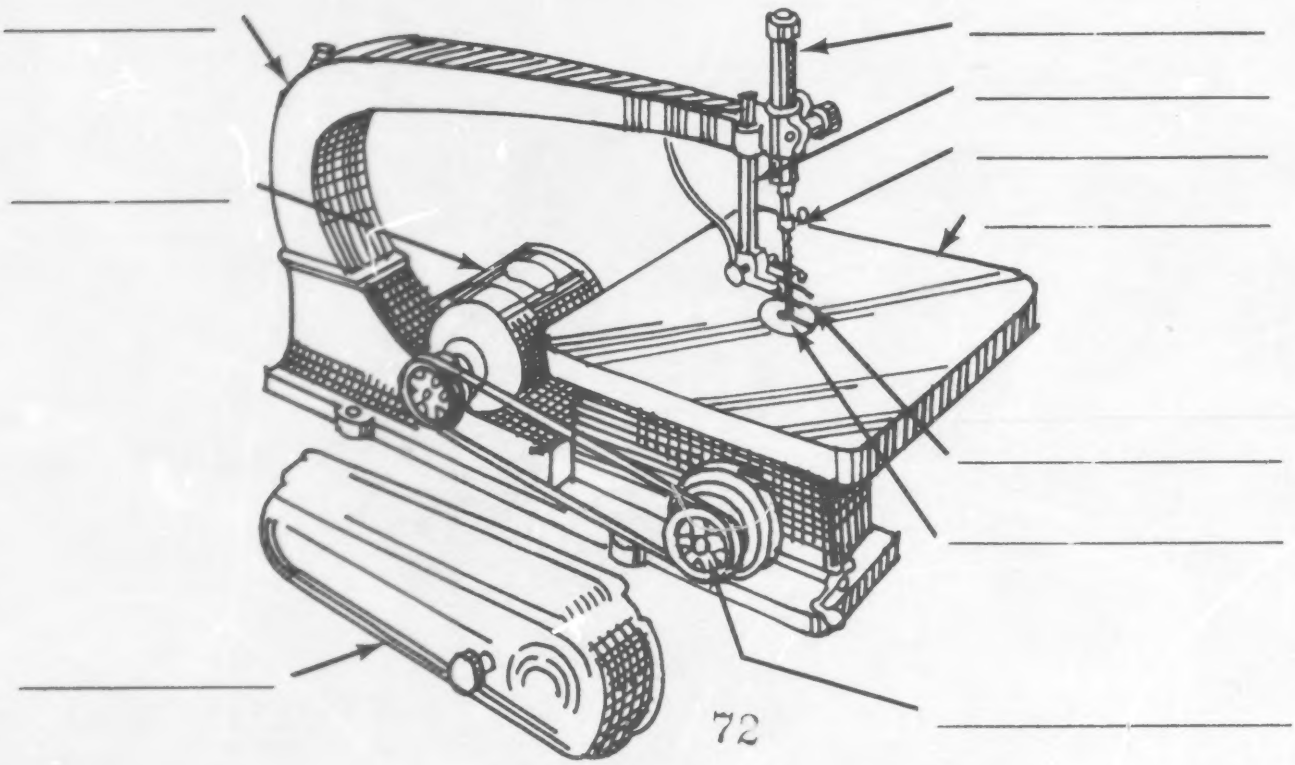
2. Eye protection must be worn. T F

3. It is not necessary to have the flat side of the stock next to the table. T F

4. Fingers should be kept away from the line of cut. T F

5. Adjustments may be made while the saw is running. T F

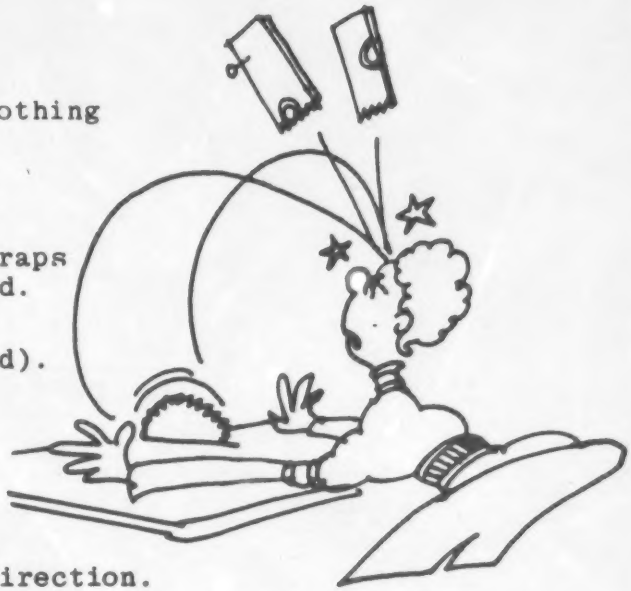
6. The hold-down should bear lightly on the work. T F



OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Table Saw

SAFETY SUGGESTIONS



1. Wear appropriate eye protection.
2. Remove jewelry, eliminate loose clothing and confine long hair.
3. Use properly secured and adjusted guards at all times.
4. Make all adjustments and remove scraps with the machine completely stopped.
5. Select proper blade and set at correct height (1/8 inch above wood).
6. Never saw freehand - never reach over the saw blade.
7. Stand to the side - not in line with the blade.
8. Make sure blade is installed with the teeth pointing in the proper direction.
9. A push stick should be used when the hands come within 3 inches of the blade.
10. Use the rip fence for ripping and miter gauge for crosscutting.
11. Stop the machine, lower blade below table, and clean up scraps when completed.

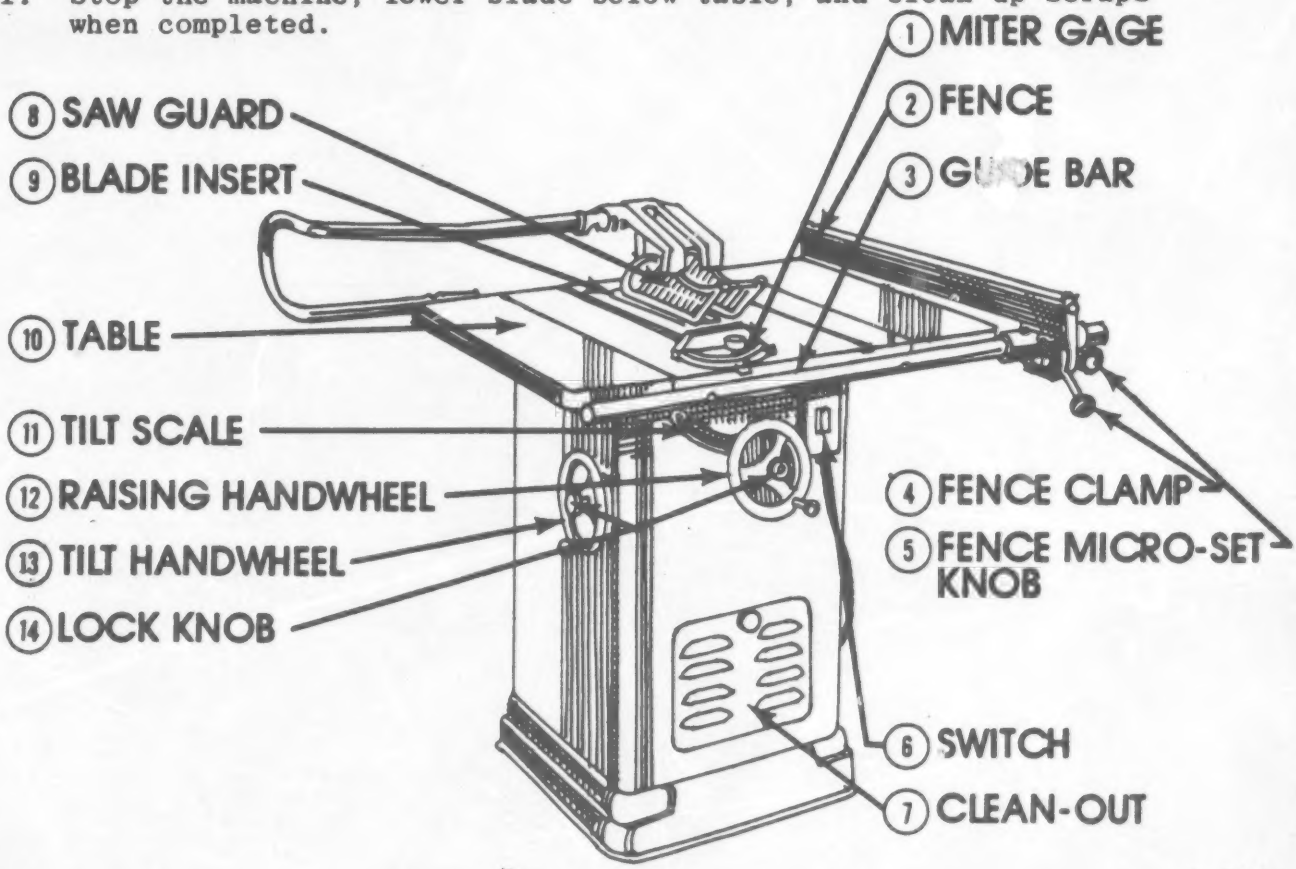
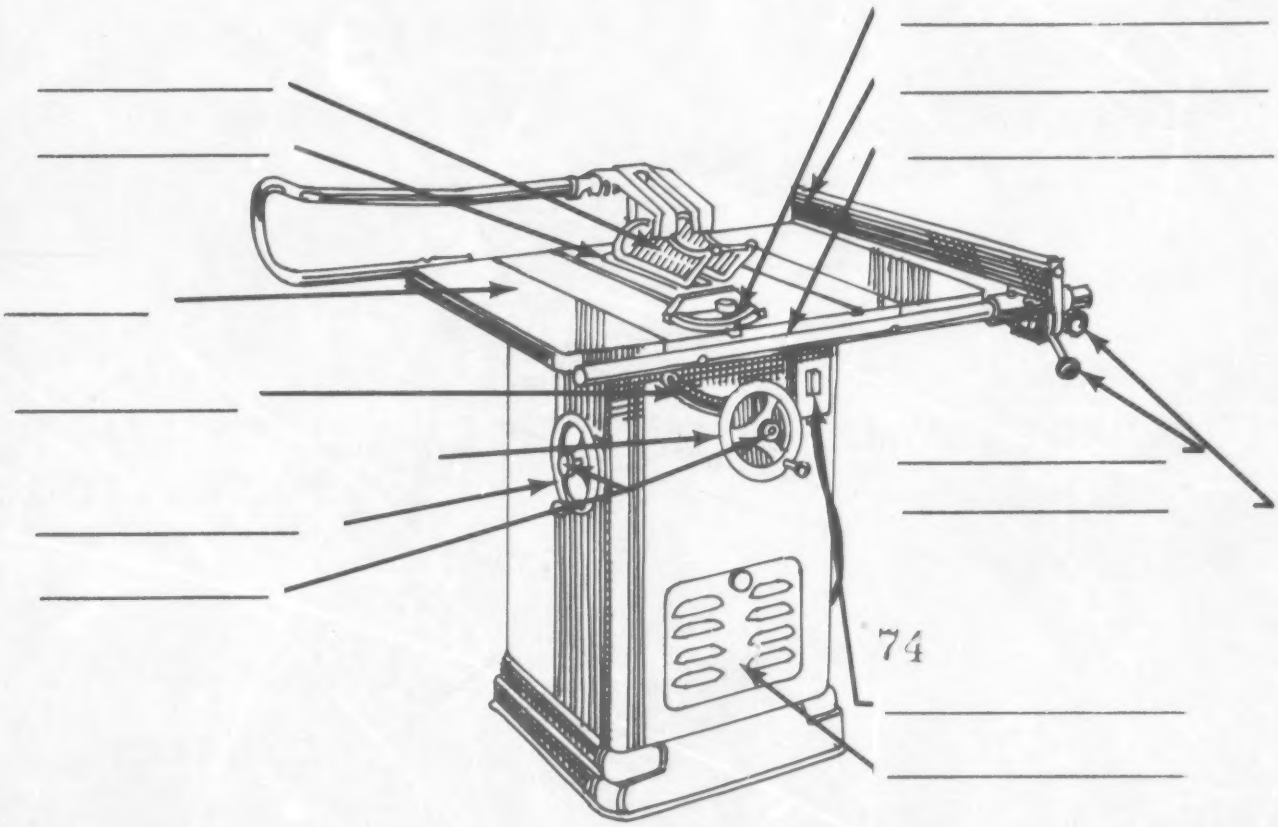


TABLE SAW

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1.	It is safe to saw freehand.	T	F
2.	The fence should always be used.	T	F
3.	The guard is not always necessary.	T	F
4.	When ripping it is best to stand directly behind the blade.	T	F
5.	Eye protection should be worn when using a table saw.	T	F
6.	The saw blade should be adjusted so that the teeth clear the thickness of material by the depth of the teeth.	T	F
7.	A helper or roller should be used when ripping long pieces.	T	F
8.	A push stick is necessary when ripping narrow stock.	T	F



OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Metal Shaper

SAFETY SUGGESTIONS

1. Wear adequate eye protection.
2. Make adjustments and measurements only when the machine is at a complete stop.
3. Securely mount the work piece in the holding device.
4. Make certain that the ram and head will clear the work and holding devices.
5. Keep hands and fingers a minimum of 6 inches from the cutting tool and all other moving parts.
6. Avoid laying tools on the machine.
7. Avoid standing directly in front of or behind the ram.
8. Make sure machine comes to a complete stop before leaving it.
9. Never remove chips while the machine is in motion.
10. Return the machine to normal and all tools and equipment to the proper storage place.

METAL SHAPER

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1. It is permissible to use compressed air to remove chips while the machine is running. T F

2. Eye protection must be worn. T F

3. A heavy cut may get the job done more quickly but also could be unsafe. T F

4. Chips may be removed while the machine is running. T F

5. All clearances should be checked before the ram is set in motion. T F

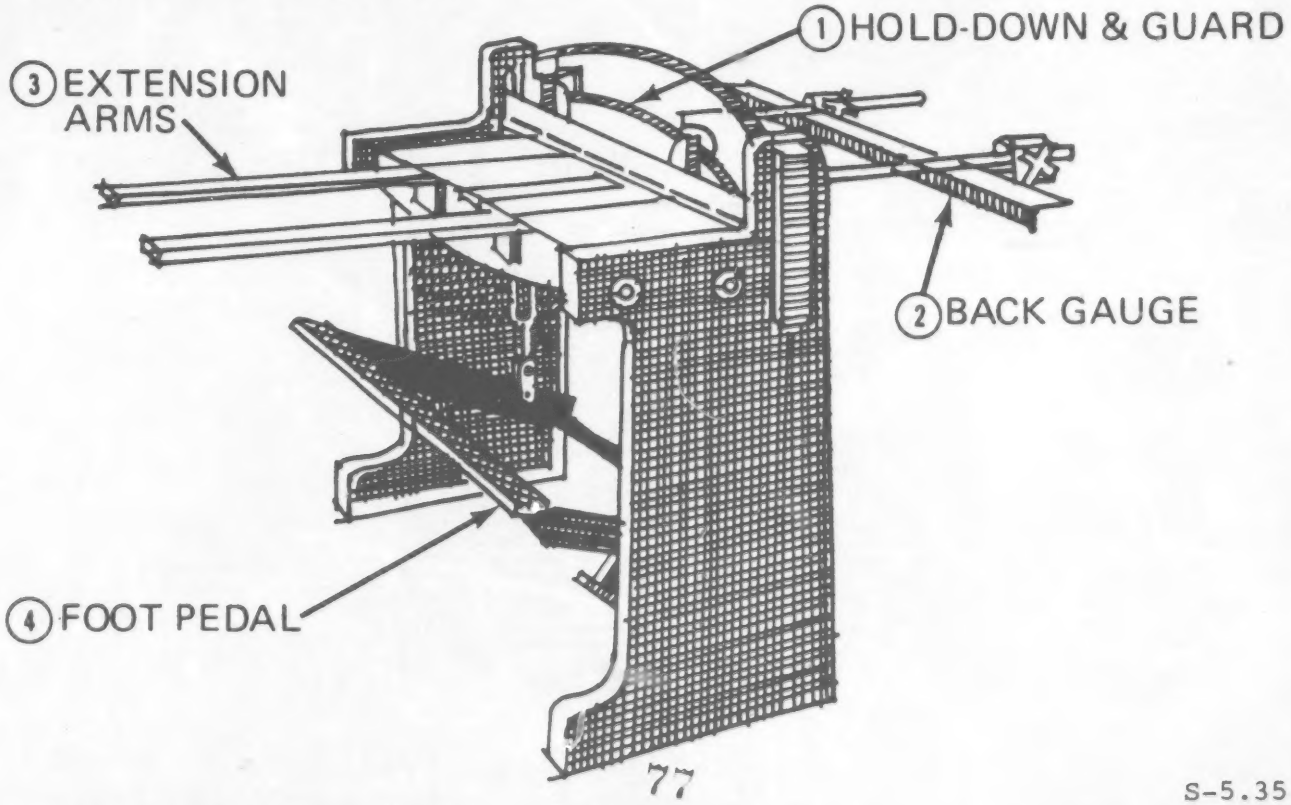
6. All set-ups should be approved by your instructor. T F

Metal Squaring Shear

OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

SAFETY SUGGESTIONS

1. Check setup and machine before operating.
2. Never surpass the capacity of the machine.
3. Feed and operate from the front or the operator's position.
4. Always keep your fingers away from the pressure bar and blade, a minimum of 4 inches.
5. Keep the foot that is not being used out from under the treadle.
6. Allow small pieces to drop; do not attempt to catch them.
7. Remove burrs before working; gloves or pads are recommended for handling sheet metal, especially large pieces.
8. Place scraps or trimmings in metal waste container and return machine to normal.
9. Whenever two people are needed to operate the shear, one shall be the operator, the other the helper.



METAL SQUARING SHEAR

Student Name _____
Class _____
Date _____ Grade _____

SAFETY QUIZ

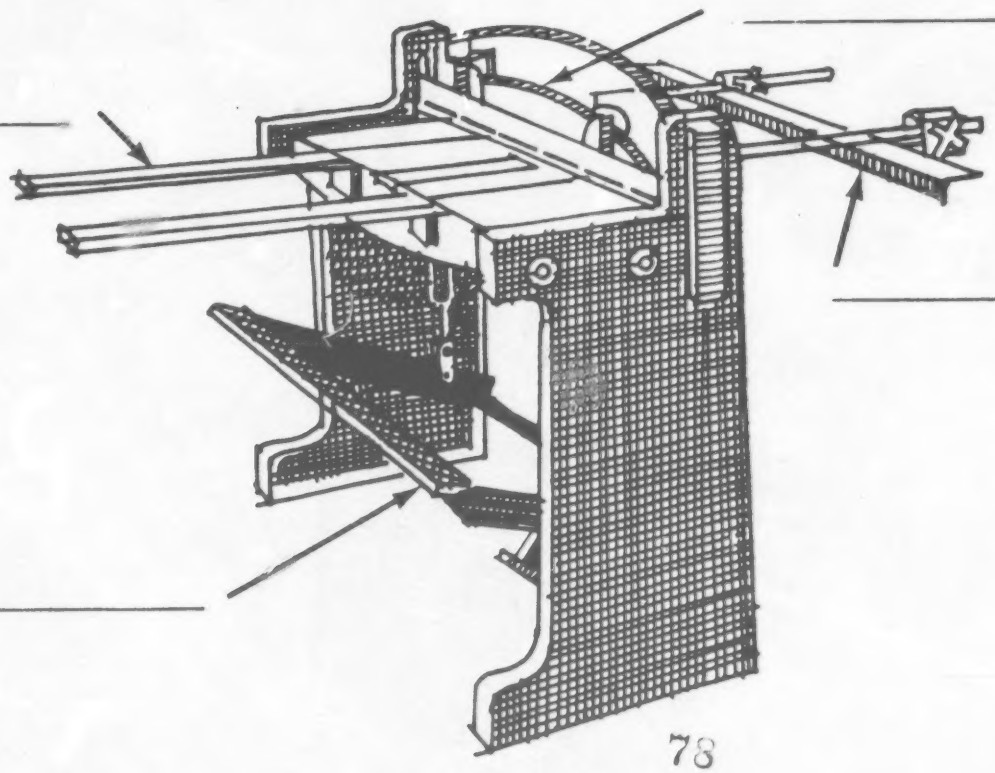
1. Feed and operate from the treadle side of the machine only. T F

2. It is permissible to let small pieces drop into a box as they are cut T F

3. Two students may operate the shear together. T F

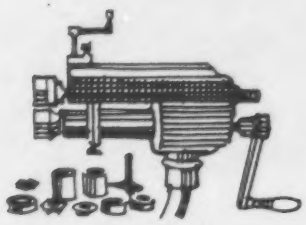
4. For some projects the guard can be removed. T F

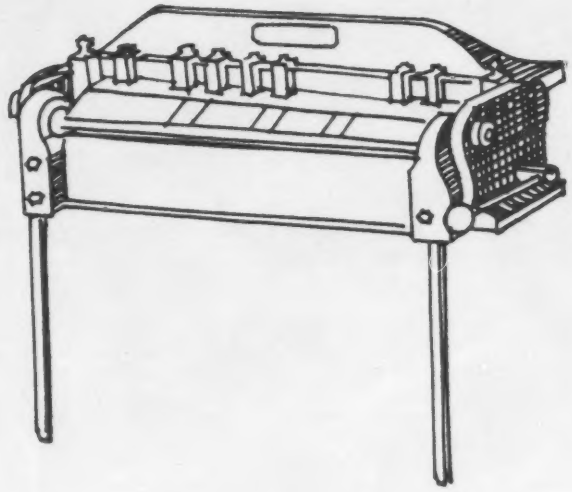
5. The foot treadle should be so arranged that there is a 2" floor clearance at the bottom of a stroke. T F



OBTAIN PERMISSION
FROM THE INSTRUCTOR
BEFORE USING THESE MACHINES

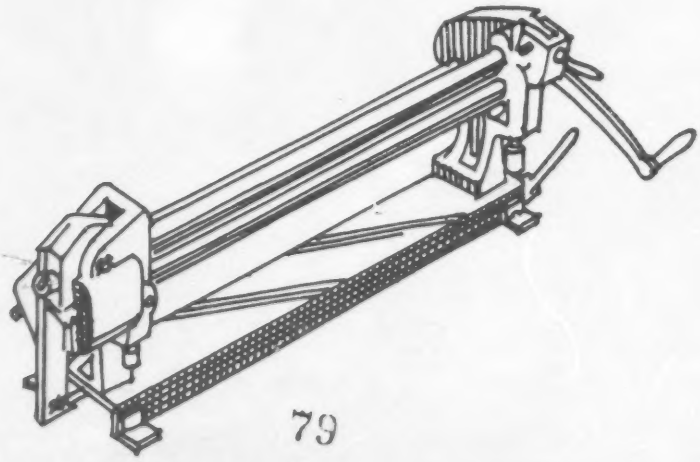
Sheet Metal Machines





SAFETY SUGGESTIONS

1. Remove sharp burrs and edges from sheet metal before attempting to work it in the machines.
2. Never attempt to bend, roll, crimp, bead, etc., metal which is heavier than the capacity of the machine.
3. Keep hands and fingers clear of moving parts.
4. Never work more than one thickness of metal.
5. Avoid slamming or dropping the handles.
6. Be careful that moving parts or metal do not strike others.
7. Take care not to place hands in a position that will allow them to slip into the rolls, jaws, etc.



SHEET METAL MACHINES

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1. The infeed rolls of a roll machine are dangerous. T F

2. Sheet metal machines can be damaged by overloading. T F

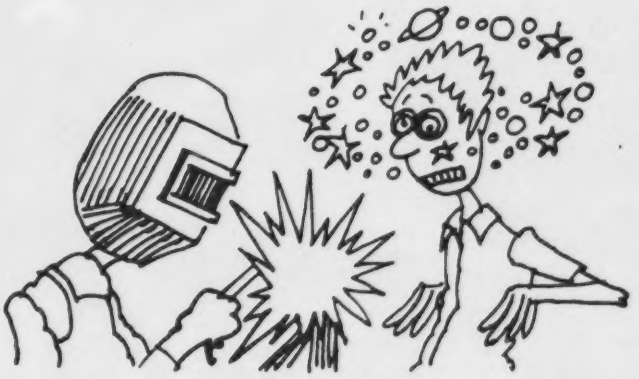
3. Sharp burrs and edges should be removed before attempting to place in the machine. T F

4. Fingers must be kept clear of moving parts. T F

5. Quarter inch mild steel stock can be formed on the sheet metal machine. T F

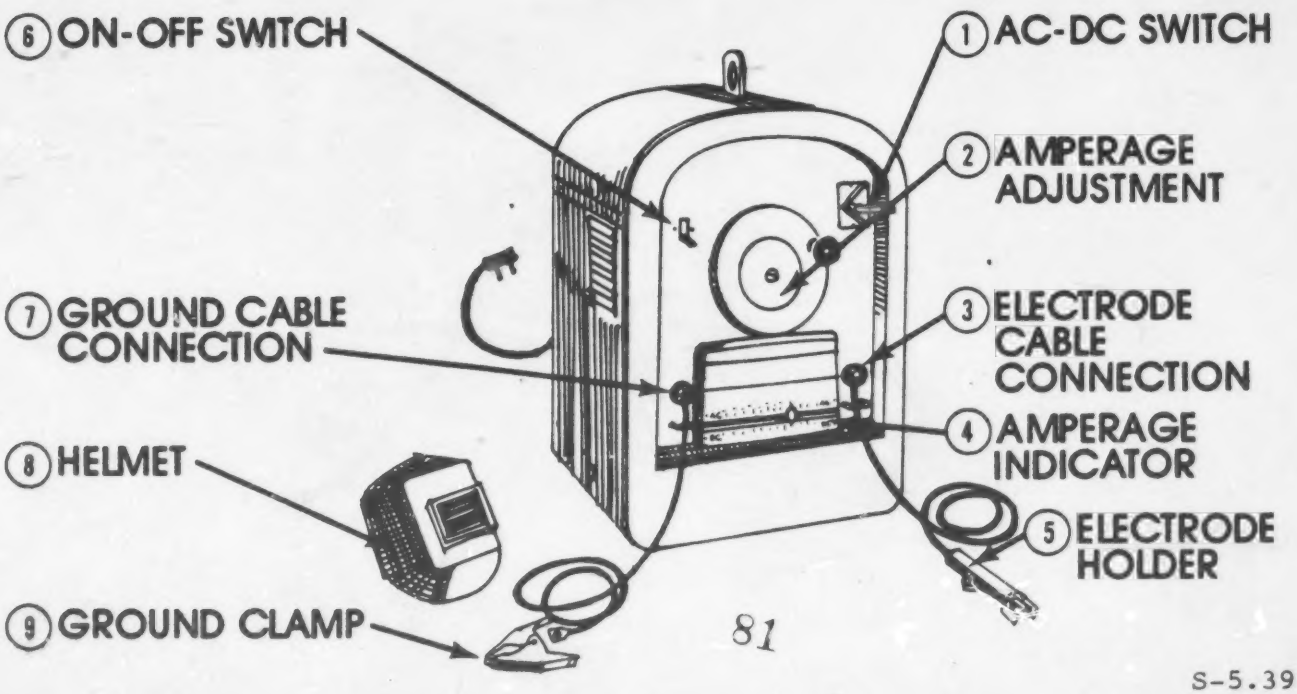
OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Arc Welder



SAFETY SUGGESTIONS

1. A welding helmet must be worn when welding.
2. Proper ventilation must be available.
3. Goggles must be worn when chipping slag.
4. Others in the area must be warned prior to striking an arc.
5. Gloves and proper clothing must be worn when welding.
6. Closed containers should not be welded without the instructor's permission.
7. Do not stand in wet areas while welding.
8. Screens to protect others must be in place before welding is started.



S-5.39

ARC WELDER

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

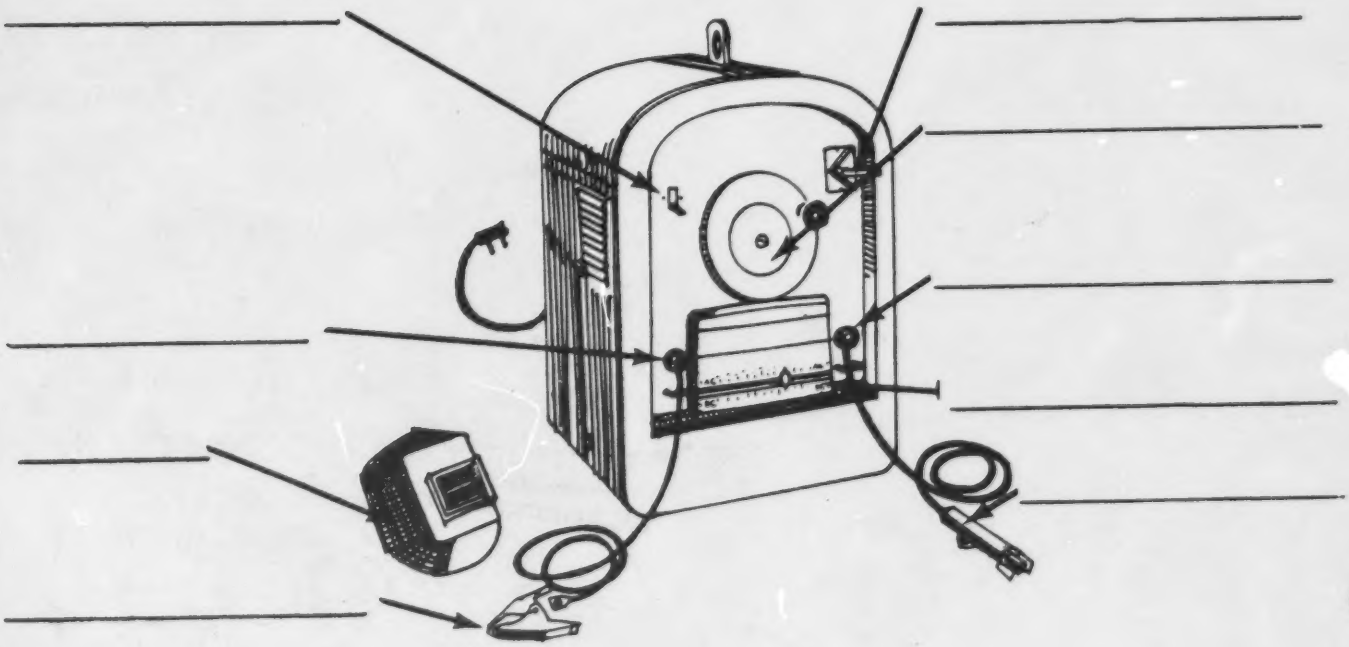
1. You should warn anyone nearby when you start to weld. T F

2. Goggles as well as a welding hood should be available before you start to weld. T F

3. A closed container is dangerous to weld. T F

4. Gloves are not necessary when welding. T F

5. It is dangerous to weld without proper ventilation. T F

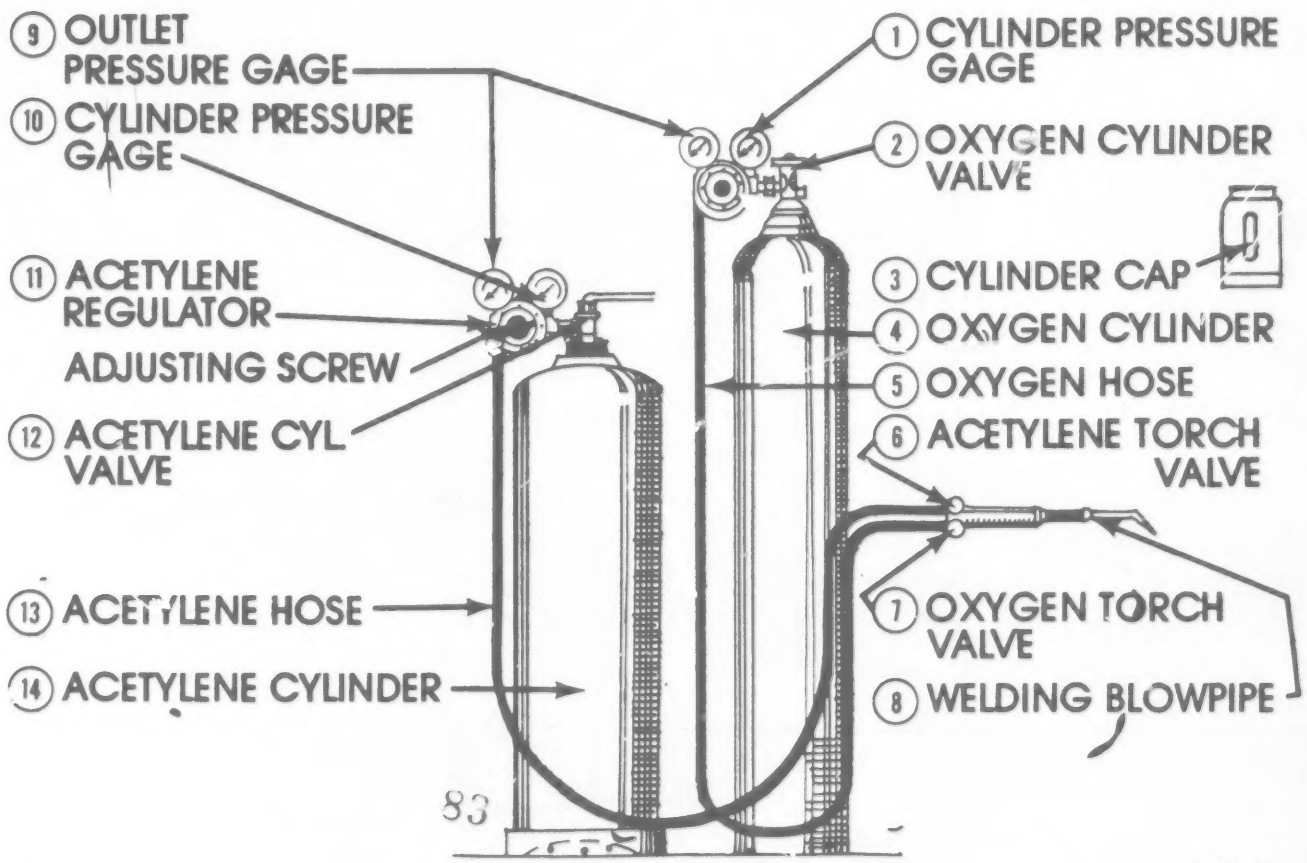


OBTAIN PERMISSION
FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Oxy-Acetylene Welder

SAFETY SUGGESTIONS

1. Do not weld galvanized metal without proper ventilation.
2. Do not allow oil to come in contact with hoses or equipment.
3. Gas bottles must be erect and secure at all times.
4. Protective goggles and spark-resistant clothing must be worn when welding.
5. Do not weld or cut on a closed container without instructor's approval.
6. Confine all cutting and welding to the designated area in the shop.
7. Turn off torch valves when finished with equipment.
8. Keep the cylinder caps on the bottles when not in use.
9. Turn off gas and oxygen at tanks or stations at the end of class session.
10. Bend the end of long welding rods to identify hot end and to reduce potential exposure to eye injury.



OXY-ACETYLENE WELDER

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

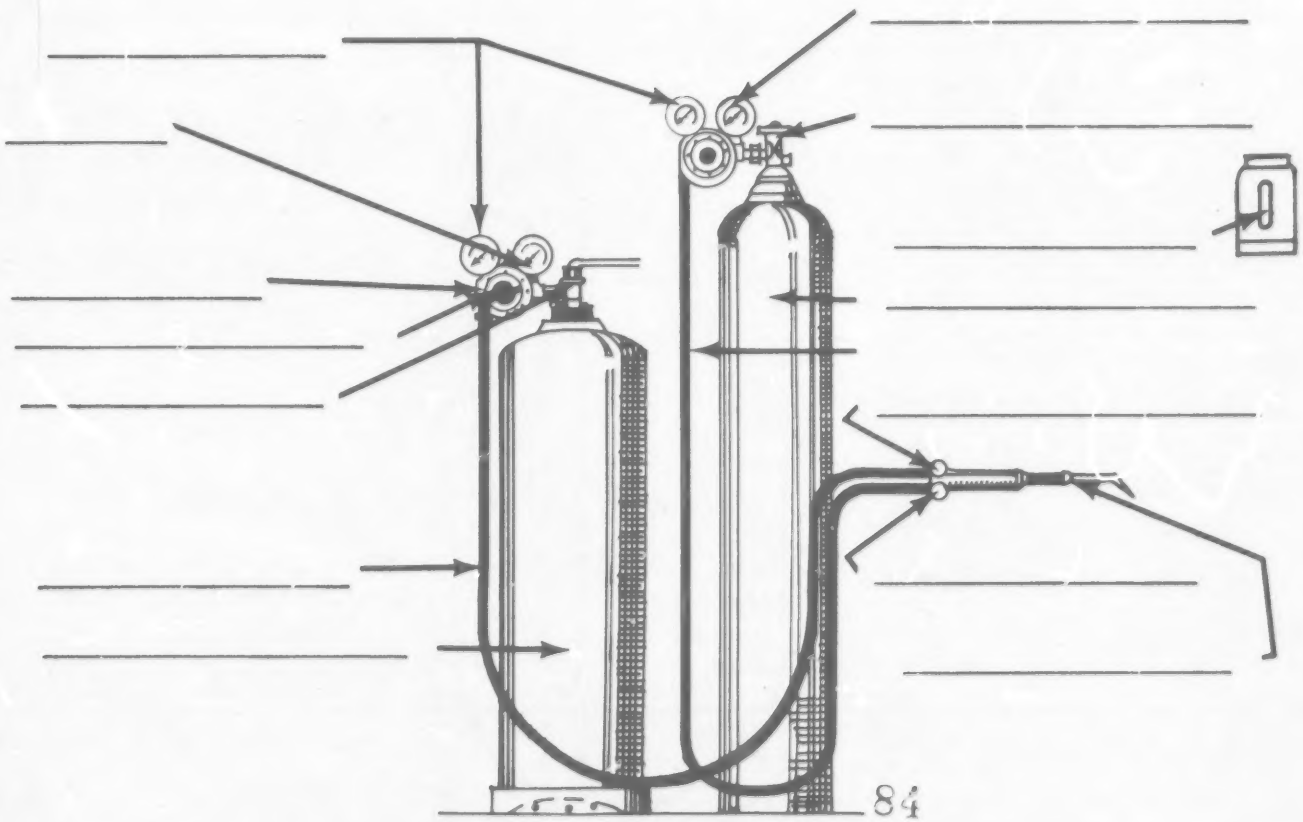
1. Gas bottles may be laid on the floor when not in use. T F

2. Closed containers are not hazardous to weld or repair. T F

3. The cylinder caps should be placed on all bottles when not in use. T F

4. Eye protection must be worn for all welding, cutting and chipping operations. T F

5. The equipment should not be wiped down with oily rags. T F



OPERATION CHECK LIST
OXY-ACETYLENE WELDER

1. Obtain permission from the teacher to use oxy-acetylene welder. ( )

2. Adjust welder for operation in following sequence:

   a. Inspect regulator's adjusting screws to insure that they are all the way out (counterclockwise). ( )

   b. Open oxygen cylinder (green) valve slowly. (wide open -- stand to one side) ( )

   c. Open acetylene cylinder (red) valve (¼ to ½ turn) ( )

   d. Open the torch oxygen valve one turn. ( )

      (1) Turn oxygen regulator valve adjusting screw until proper reading is obtained. (See chart for tip being used.) ( )

      (2) Turn off torch oxygen valve. ( )

   e. Turn the acetylene regulator adjusting screw in slowly until correct reading is obtained for tip being used. ( )

3. Lighting torch procedure:

   a. Turn torch acetylene valve 1/16 of a turn, then ignite acetylene gas coming from tip with spark lighter. ( )

   b. Readjust the acetylene regulator adjusting screw until the correct reading is obtained. ( )

   c. Turn acetylene torch valve on slowly until flame jumps away from tip, then slightly reduce the fuel supply to bring the flame back to the tip. ( )

   d. Adjust torch oxygen valve to obtain neutral flame. ( )

Do I understand the following operating instructions?

1. I must wear welding goggles when gas welding. Yes No
2. I must never lay down a lighted torch. Yes No
3. I must never use acetylene gas at a pressure greater than 15 lbs. per square inch. Yes No
4. I must be careful not to burn hoses. Yes No
5. I must replace goggles, hoses and torch in proper places and clean up area when I am through welding. Yes No
6. I must have teacher check my set up before lighting torch. Yes No

STUDENT'S NAME_____ TEACHER'S INITIALS_____